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Metacognition and attribution for learning outcome amongst children in the primary school

METACOGNITION AND ATTRIBUTION FOR LEARNING OUTCOME AMONGST CHILDREN IN THE PRIMARY SCHOOL

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MEMORANDUM

This is to certify that the work contained in this dissertation is my own work except where acknowledged and stated in the text.

Signed: K Thorpe.

Karen J. Thorpe

Date : 29/11/88

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ABSTRACT

According to Weiner's application of attribution theory to the examination of motivation in the classroom, it is not the outcome of learning *per se* but rather the child's understanding of this outcome which will predict subsequent motivational behaviour. This understanding is manifested in the explanations the child gives for his learning outcome. The present study worked within the framework of Weiner's proposals. It examined the relationship between the child's general knowledge and understanding of learning (*metacognition*) and his explanations for learning outcome (*attributional behaviour*).

Two relationships between metacognition and attribution were hypothesised. The first was developmental: that metacognition is an underlying, developing process of which attribution is an expression. The second was causal: that the child's level of metacognitive functioning structures the salience of attributes in the learning context and effects the definition of learning outcome and its subsequent explanation. These hypotheses were examined in a study of 144 primary school children in the age range seven to eleven years.

Two studies were conducted. The first was a preliminary investigation of the nature of metacognition and was designed to select indices of metacognitive functioning. The second study investigated the hypothesised relationships between the child's metacognitive scores and his attributional behavioural. Attributions were elicited from each child following a learning task which was undertaken under one of four learning conditions in which outcome definition (two levels: external versus self defined) and Processing (two levels: meaningful versus verbatim) were varied. The effects of age , metacognitive level, outcome definition, and processing on attributional behaviour were examined using analyses of variance techniques.

The findings of Study One indicated that metacognition as measured, was disunified. Individual measures were weakly related. Eight variables were selected to index metacognition. The findings of Study Two indicated that there was only a weak relationship between the eight metacognitive indices and attributional behaviour. Nevertheless, three metacognitive indices predicted attributional behaviour more strongly and these were further investigated. Using an aggregation of these three indices to represent metacognitive functioning effects of development and learning conditions on attribution were found.

Attribution to Strategy types and Specific Ability and corresponding increases in internal, controllable, specific and unstable attributions were also found to increase with age and metacognition.Increased controllable attributions were also found. These findings provided support for the developmental hypothesis.

The findings also provide partial support for the causal hypothesis. Whilst few effects for outcome definition were found clear processing effects emerged. Processing was found to interact with metacognition and age and with metacognition alone to affect attributional behaviour.

The study provides some indication of a relationship between metacognition and attribution for learning outcome. However, the need for further investigation is evident, in particular the clarification and further investigation of the concept of metacognition and individual studies of the effects of learning condition on attribution behaviour.

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The light of lights
Looks always on the motive, not the deed,
The shadow of shadows on the deed alone

W. B. Yeats

INTRODUCTION

Theories of school achievement have employed a number of constructs to explain individual differences in academic performance. Alongside ability and attitudinal factors, motivation has played a prominent part. Cattell, Sealy and Sweney (1966), for example, argued that up to 25% of primary school achievement variance could be predicted from motivation scores - an amount equivalent to that predicted from ability and from personality factors.

Although the modern primary school is often held to be a hive of productive thinking, observation reveals large differences between children in the measurable effort made in most branches of the curriculum. Explanations of such differences have changed considerably over the sixty or so years since systematic psychological studies of pupils was introduced into the study of education. During the 1930s, largely influenced by McDougall (1908), instinct explanations abounded such that textbooks emphasised the inherited factors common to the species which energised and sustained learning. As the list of human instincts postulated grew to some several thousand the absurdity of this approach was realised, however. Gradually, and under the influence of psychologists who put forward conditioning as a model of learning, instinct theories were replaced by theories of innate drives which impelled adaptive behaviour from within, or of basic needs which could be met and the drive reduced to goal seeking (appetitive) and satisfying (consummatory) behaviour. Although impressive studies of drive manipulation (for example, of hunger) were carried out by Skinner and others using rats and pigeons and valuable insights were attained from ethological studies (for example, by Lorenz (1974) and Tinbergen (1951)), it remained unclear just which drives were supposed to be satisfied by school achievement. This led Murray (1938) and others to distinguish physiological (which played little part in school achievement) and psychological drives or needs, among which need for achievement (n Ach) was assigned a prominent role.

Explanations of individual differences in achievement in terms of differences in "need to achieve" were destined to be circular and the 1960s and 1970s saw a decline in the use of these kinds of explanation. Since this time psychologists have adopted approaches which have tried to emphasise the pressures in the child's environment which influence his efforts to learn (parental and teacher expectation, competition, incentives, models and so on) or have adopted cognitive theories in which the child becomes an agent in his own learning activity seeking to achieve self- or other-defined goals which may be realised by adoption of the rules of social adaptation. Such theories have in common a model of the child who is aware of his goals, increasingly knowledgeable of acceptable (and unacceptable!) ways of reaching them and of his characteristics as a learner. Moreover, the child is seen as aware of the connections between his actions and his intentions, between his abilities and efforts and the outcome of his attempts to learn. Under the enforcing influence of his results and his teacher's evaluation of them, the child develops a concept of his status as a learner. Whereas the child depends in the early stages of formal schooling on a teacher definition of success or failure, this generally gives way to evaluation of peers and later by self such that at secondary level a child's judgement of his attempts to learn may differ substantially from that of his teacher.

The parent psychological theory which has given rise to these kinds of view of school motivation is that of "attribution theory", especially in its adaptation to school achievement and motivation by Weiner (1979). Basically, this theory gives prominence to the child's developing understanding of the factors (reasons and causes) which influence the outcome of his attempts to learn: the precise influence on his future motivation is his belief as to whether the outcome is influenced by factors internal to self (such as ability and effort) as compared with external factors over which he may have little or no control. Whereas reinforcement theories hold the results (especially if rewarding) to be the major determinant of learning, attribution theories argue that it is the type of explanation of the result which is of greater significance. Thus, although the reward of a "correct" response is itself pleasant and rewarding, its influence on motivation and expectancy for future performance will be greater if the child attributes his success to causes of which he feels proud, namely those internal to self.

The importance of awareness of the cause of success in attribution theory is paralleled by an increasing interest in developmental psychology in a child's general and specific understanding of how his learning takes place and how his memory can be used to greatest effect. This knowledge about knowledge (metacognition) has been shown to develop over the primary school years but only recently have psychologists come to hypothesise a link between metacognition and increasing awareness of influences on learning as detailed by attribution theory.

It is with this relationship that the present study is concerned. It is intuitively plausible that awareness of the processes of one's own learning (an aspect which might be called the cognitive self) is an essential prerequisite for an understanding of the extent to which one's own learning is caused by internal factors. It is thus likely that what is called metacognition is the "underlying construct" and attribution for learning outcome of one of its manifestations.

The present study focusses on the relationship between metacognition and attributional behaviour in junior school years (seven to eleven years). Children of this age are of special interest not only because metacognition has been shown to make some of its greatest developmental strides during this period but also because these years represent the transition between the infant school, where motivation is commonly held to be high, and the secondary school where, for many children, this is decidedly not the case.

The study remains within the achievement motivation frame of reference. It examines one cognitive theory of achievement motivation - attribution theory - which is currently popular in the fields of Psychology and Education (see, for example, Hewstone, 1988). Specifically, it is concerned with Weiner's (1979) application of the theory to education which proposes that the child's understanding of his learning outcomes will affect his expectancy and subsequent motivation toward achievement tasks. The child's understanding is reflected in his explanation for learning outcome.

The central thesis of the study is that, with age and metacognitive development, the child's understanding of learning will change. This will affect the child's perception of learning tasks and will subsequently be reflected in explanations given for learning outcome. Two possible relationships between metacognition and attribution for learning outcome are hypothesised. The first is developmental: that attribution for learning outcome is an expression of underlying cognitive development. The second is causal: that the child's metacognitive level structures the salience of attributes in the learning context.

The thesis is organised as follows:

Chapter One presents a discussion of the concept of metacognition. The existing research in the field is reviewed and problems and issues discussed.

Chapter Two outlines Attribution Theory with particular reference to Weiner's application of the theory to classroom motivation. Once again, problems and issues of the theory are discussed.

Chapter Three examines the relationship between metacognition and attribution for learning outcome. Theoretical, conceptual and empirical relationships are discussed. Two possible relationships between metacognition and attribution are hypothesised: developmental and causal.

Chapter Four outlines the research questions and presents the research design for the study. The research design entails two separate studies: the first, an examination of the nature of metacognition; the second, a study of attribution and its relationship with metacognition.

Chapter Five presents Study One which examines the nature and measurement of metacognition. On the basis of findings in this study, variables are selected to index metacognition in Study Two.

Chapter Six presents Study Two which examines the patterns of attribution for learning outcome and their relationship with metacognition. To test the developmental hypothesis, the effects of age and metacognition on attribution for learning outcome are examined. The causal hypothesis is tested in a 2 x 2 experimental design in which the effects of metacognition on attribution for learning outcome are examined following different conditions of learning outcome definition (external- versus self-defined) and processing orientation (Verbatim versus Meaningful).

Chapter 7 presents a summary of the results and a discussion of each in relation to the research questions.

Throughout the study the child will be referred to as "he". This is a language formality necessitated by the absence of an appropriate neutral word for this context in the English language. It does not connote greater importance of boys. In each case it should be read as referring equally to both boys and girls.

CHAPTER 1

METACOGNITION

1.1 OUTLINE OF THE CONCEPT

1.1.1 DEFINITION

Individuals in a learning situation are not only capable of directed cognitive activity - attending, remembering, recalling - but also of observing and monitoring their behaviour. Presented with written prose, for example, the experienced reader consciously considers a range of reading strategies (scanning, skimming, selective reading, elaboration) and selects the one appropriate to his purpose (Smith, 1967; Forest and Waller, 1981; Lunzer and Gardener, 1979; Gibson and Levin, 1975). Moreover, the reader monitors his own progress in comprehending the text at the level selected. This process of deliberate observation and monitoring of one's own behaviour is termed metacognition.

The concept of metacognition is derived from that of the earlier notion of metamemory (Flavell, 1970, 1971). This has been defined as

> *the individual's knowledge and awareness of memory*
> (Flavell and Wellman, 1977, page 4)

Underlying this concept is the premise that individuals not only cognize objects, events and behaviours but also cognition itself.

> *Individuals form and hold conceptions about how the mind works, which mental problems are hard and which are easy and their own mental states.*
> (Flavell, 1971, page 273)

More recently the concept has been expanded to include the processes of self-regulation and monitoring and has thus been termed metacognition (Brown, Bransford, Ferrara and Campione, 1983). It has been defined as

one's knowledge and control of the domain cognition

(page 106)

1.1.2 Some Distinctions Within the Concept

The scope of metacognition is extensive. It is ubiquitously associated with cognitive activity. In an attempt to better define the range of metacognitive phenomena a number of categorical distinctions within the broad concept have been made. Firstly, a distinction is made between metacognitive experience and metacognitive knowledge (Flavell, 1981b; Robinson, 1983). Metacognitive experience refers to conscious experiences of knowing (Brown and McNeill, 1966; Wellman, 1977) or of failing to understand (Flavell et al., 1981; Robinson and Robinson, 1977). In contrast, metacognitive knowledge is an "accumulated world knowledge" about cognition and the cognitive environment (Robinson, 1983).

Secondly, a distinction is made between metacognitive knowledge and metacognitive production (Flavell and Wellman, 1977). Metacognitive knowledge refers to verbalised knowledge about cognition whilst metacognitive production is concerned with the application of metacognitive principles in performance. This distinction has been made because it has been found, particularly in developmental studies, that whilst individuals may indicate understanding of metacognitive principles verbally, they may not be able or may not choose to use them in practice (Flavell, 1970; Siegler and Liebert, 1975).

Finally, a further distinction is made between the application of metacognitive knowledge and the regulation of one's own learning behaviour. Brown et al. (1983)

have argued that whilst metacognitive knowledge and regulation are related fields, they are conceptually distinct. Metacognitive knowledge is typically concerned with the individual's knowledge about variables in the learning context and choice of strategy. Flavell and Wellman (1977) suggest that individuals acquire knowledge about three groups of variables: personal, task and strategy. Knowledge about these variables and how they interact will influence strategy choice and learning performance (Flavell and Wellman, 1977). Regulation, in contrast, is concerned with processes. Brown and Deloache (1978) suggest it includes processes of predicting, monitoring, checking, reality-testing, co-ordinating and controlling learning.

Metacognitive experience is not examined in the present study. The parameters of metacognitive phenomena examined are restricted to metacognitive knowledge and regulation. The focus is on the application of metacognitive knowledge in generating strategies and the monitoring of their effectiveness.

1.2 THE DEVELOPMENT OF METACOGNITION

1.2.1 THE DEVELOPMENT OF INTENTIONAL COGNITIVE BEHAVIOUR

Metacognition is concerned with intentional learning (Flavell and Wellman, 1977). The starting point of metacognitive development, therefore, is the recognition of learning as a problem. The child must recognise the need to do *something* if learning is to advance beyond the incidental.

A number of studies of memory tasks have examined the emergence of such deliberate cognitive behaviour. A study by Appel et al. (1972), for example, compared the strategies and subsequent recall of children aged four, seven and eleven years following a memory task presented under two conditions: incidental and intentional. In the incidental condition the children were instructed to "look carefully" at a series of items; whilst in the intentional condition children were instructed to remember the items. The results indicated that the eleven year old children distinguished between the two conditions. Under the intentional condition they responded by using rehearsal strategies which were not evidenced under the incidental condition. Subsequent recall was superior following intentional learning. In contrast, the four year olds made no distinction between the two conditions. Their behaviour and recall performance across the two conditions were not significantly different. The authors concluded that whilst eleven year olds recognised the need for intentional behaviour, four year olds did not. The results for the seven year olds were less clear. Whilst trends indicated differences in behaviour and recall across the two conditions, no significant differences emerged. Appel et al. (1972) suggested that seven year olds distinguished conceptually between the two conditions but not behaviourally.

A number of subsequent studies have replicated the design of Appel et al. (1972). These have produced varying reports of the age at which deliberate cognitive behaviour emerges. Yussen (1974), for example, reports that four and five year olds do discriminate between incidental and intentional conditions. He reports that children of this age "look more" under a memorise instruction. Wellman et al. (1975) report that children as young as three differentiated between remember and look conditions when presented with "concrete" items to remember. It would seem that age differences in the emergence of intentional cognitive activity are specific to the task presented. Deliberate memory behaviour is reported to emerge earlier when the task is concrete, as when the child is required to remember familiar objects which are physically presented (Wellman et al., 1975).

1.2.2. THE DEVELOPMENT OF METACOGNITIVE KNOWLEDGE

It is evident that recognition of the need to "do something" when trying to learn and remember develops early. However, the repertoire of metacognitive knowledge and strategies - "what to do" - changes considerably through the school years and most particularly in the primary school years. Through learning and experience in this period the child's metacognitive knowledge increases.

The following discussion outlines research which has examined the development of metacognitive knowledge and processes. The studies discussed are drawn from a diverse body of literature. Research has typically examined metacognition specific to a particular cognitive task. The result is an extensive but disparate literature. There are, therefore, numerous studies which might be considered here. The discussion does not provide an exhaustive account but rather attempts to provide a cross-section of research conducted. For the purpose of clarity, the taxonomy of metacognitive knowledge outlined by Flavell and Wellman (1977) is employed. This describes three classes of metacognitive knowledge: personal, task and strategy. Finally, the processes of metacognitive development are considered.

Knowledge of Personal Variables

Personal variables are those attributes or states of the individual which influence learning. These might include idiosyncratic attributes. Research has focussed on the acquisition of knowledge about the capacities and limitations of memory.

The child's knowledge about the limitations and capacities of memory has been shown to develop throughout the primary school years. Whilst studies show that young, school-aged children use terminology like "remember" and "forget" (Wellman and

Johnson, 1979; Shatz, Wellman and Silber, 1983) and indicate some knowledge of the relationship between the strategy used and remembering (see, for example, Kreutzer, Leonard and Flavell, 1975), studies examining children's behaviour indicate their application increases with age. Three sources of evidence indicating this development are commonly referenced: studies of the child's prediction of ability, prediction of recall readiness and monitoring of understanding.

Predicting Ability

Studies examining the child's prediction of his or her own memory ability document increased accuracy of prediction with age (Yussen and Levy, 1975; Markman, 1973; Flavell, Freidrichs and Hoyt, 1970). The study of Flavell, Freidrichs and Hoyt (1970) is a good case in point. It compared the accuracy of prediction of children in two age groups: four to six years and seven to ten years. The children were asked to predict how many objects they would be able to recall in serial order and were subsequently tested for their ability to do so. The results indicated that the younger children "unrealistically" over-estimated the number of items they could recall whilst the older group were more accurate. In a similar way, Yussen and Levy (1975) compared the predictive accuracy of four, eight and twenty year olds on a memory span task. Again, results indicated that prediction more closely approximated actual recall with age. Further it was found that the ability to use feedback to improve the accuracy of prediction varied with age. The youngest subjects in the sample did not adjust their predictions on the basis of feedback but remained optimistic. A study by Markman (1973) would further suggest that these findings are not simply the result of a generalised inability to predict performance. She examined the predictive ability of five years olds on a variety of tasks and reported that, whilst these children were able to predict their physical ability (how far they could jump) and utilise feedback to improve their predictions in this domain, they did not have the same understanding of their own mental capacities.

Predicting Recall Readiness

Studies of the child's ability to predict recall readiness, like studies of predicting ability, also document increasing accuracy with age. In the Flavell et al. study (1970) children were instructed to study a set of items until they were sure they could remember them all. The results indicated that the younger group of children (four to six years) were less accurate in recall and therefore had been less accurate in predicting ability than the older children (seven to eleven years). Some studies have reported that this effect can be reduced with practice (e.g. Markman 1973). Others, however, have not found this to be the case, (Yussen and Levy, 1975).

Recognising a Failure to Understand

A final group of studies which are concerned with the child's knowledge of personal variables are those examining the child's knowledge of his or her own comprehension. Typically these studies have presented children with ambiguous or incomplete verbal instructions and have observed the children's subsequent reaction. Systematic results have been reported which indicate that young children tend to act rather than seek further information. In contrast, older children recognise their failure to comprehend and seek further information. Markman (1977) suggests the explanation for this finding is that young children fail to execute the instructions mentally. It is only when they act out the instructions that they realise a failure to comprehend. Older children, she suggests, recognise instructions as inadequate because they execute them mentally first. Robinson (1983) presents an alternative explanation. She suggests that young children may realise they do not understand but do not understand the reason for this. They fail to recognise that a message can be inadequate. Indeed, a number of studies report that young children judge ambiguous and incomplete messages as adequate (Flavell et al., 1981; Robinson, 1983).

Together, the results of studies of predicting ability, predicting recall readiness and monitoring comprehension indicate that children acquire more accurate understanding of their own capacities and limitations with age and, further, are better able to monitor their own performance.

Task Variables

Task variables are concerned with the attributes of the task which influence the ease or difficulty of its processing. Such attributes include:

Quantity - knowing that increased quantity increases the difficulty of learning;

Relatedness - knowing that the greater the degree of similarity or association of items the easier they are to learn;

Organisation - knowing that the greater the degree of organisation and structure of materials to be learned the easier the task.

Knowledge of Quantity

The predicting ability studies demonstrated that the understanding of the limitations of human memory capacity increases with age. The young children in the Flavell et al. study (1970), for example, believed they could remember all items presented to them in a serial learning task whilst the older children accurately predicted they could not. Older children were apparently more aware that the quantity of items they could recall was limited. The studies suggest that children not only have different awareness of their own memory capacities but also of the effects of the quantity of items to be recalled.

Evidence from studies examining judgement of task difficulty on memory sets of different size provides further information about children's knowledge of the principle of quantity. The Kreutzer et al. interview study (1975) provides a good case in point. In this study, children in the age range five to twelve years were presented with sets of word pairs. The word pairs were either arbitrary or related (antonyms). Initially, equal sized sets of word pairs were presented and the children were asked to select which set would be easiest to learn. Subsequently, additional pairs were added to the selected set until a reversal of the original choice was made. The numbers of additional sets required to bring about a reversal of decision by children of each age group were compared. The results indicted that the number of sets required to bring about a reversal of decision increased with age. Of the sixteen five year olds who initially judged one item to be easier, ten reversed their decision after only one item was added to the selected set. In contrast, eight and twelve year olds required the addition of more than three items to bring about a reversal of the initial judgement. These children were more discriminating in their judgement of task difficulty. They were not only concerned about the quantity of items presented but also about their relatedness. The study demonstrates that even the youngest school-aged child employs a principle of quantity. The authors concluded, however, that

> *younger children have a less differentiated, more all or none conception of the influence of number of items on task difficulty*
>
> (Kreutzer, Leonard and Flavell, 1975, page 17)

Knowledge of Relatedness

The results obtained in the Kreutzer et al. study (1975) indicate that with age children come to understand that related items are easier to recall than unrelated items: recall of one item serves as a cue for the recall of associated items.

A number of other studies have also examined acquisition of the principle of relatedness. Moynahan (1973) asked seven, nine, and eleven year olds to predict the relative difficulty of remembering items for which the relatedness was varied. Items were either strongly related (belonging to a single category of items) or unrelated. The number of items presented remained constant. The results revealed significant differences between the responses of seven year olds and the two older groups. The older children more frequently selected related item sets as less difficult. Salatas and Flavell (1976) found this effect remained even when the relatedness of the items was made explicit.

Knowledge of Organisation

Tenney (1975) has examined the principles of organisation used by children, aged six to twelve years, in the generation of word lists for recall. In contrast to the relatedness studies, where children were asked to judge between word lists, children were asked to generate their own lists. In this study, children were presented with twelve cue words individually and asked to provide "three other words which would be easy to remember" along with each. Responses were subsequently categorised, though not exclusively, into seven organisational types: taxonomic category, narrow category, sound relationships, consistency, category labels, function and description. Significant age effects for frequency of organisational principle use emerged for five of the seven categories. Older children made significantly greater use of categories, narrow categories, category labels and description to structure their word lists. In contrast, the use of sound relationships as an organisational principle declined with age. Younger children used sound relationships to structure their word lists significantly more than older children. Further, analysis of the consistency of principle use, both within and across the twelve trials, indicated there was an increased consistency in principle use with age. The study indicates that children as young as five years use principles of organisation to generate sentences for later recall. However, the particular principle used varies and the coherence of organisation increases with age.

Further, it has been found that children understand the advantage of providing a structure for learning even in cases where the materials to be learned do not have inherent organisation. The Kreutzer et al. study (1975) asked children to judge the ease of recall of a list of unrelated words presented either as a simple list or embedded in a sentence. Following judgement responses, the children were asked to justify their choice. It was found that both the selection of the story presentation and provision of a justification for this choice increased with age. Over 90% of the nine and eleven year olds believed the story format was preferable, of which the majority provided justification for the choice. These justifications indicated that older children felt the story aided recall by relating words which were otherwise unrelated.

Studies discussed to this point have been largely concerned with memory span tasks and list learning. Studies have also examined knowledge and use of organisational principles in prose learning. Danner (1976), for example, examined children's ability to identify organisation in prose and also to utilise it to assist later recall. His study was of children aged seven to eleven years and the research materials used were a series of stories about animals. Each story comprised twelve sentences: four sentences for each of three themes (appearance, habitat, food). In the first stage of the study the effects of organisation on recall were assessed. Children were read two stories: one thematically organised, the other disorganised. Following immediately after the reading of each story, free recall protocols were obtained. Clustering of thematically related sentences in these protocols was examined. The children were also asked to indicate which of the two stories was more difficult to remember.

Results indicated that, for all age groups, amount and clustering of recall was greater for the organised story. An increase in recall and clustering by age was also found. The majority of children in all age groups selected the disorganised passage as the more difficult of the two but few could identify organisation as the reason for this. When the two stories were presented to the children together in written form, however, it was found that older children could identify the differences. A significant age difference in identification of organisation between seven, nine and eleven year olds was found. In a final stage of the study, children were asked to group sentences from a story "that tell about the same thing" and were also asked to select from the twelve sentences three sentences which would help them remember all the story at a later time. It was found that the ability to group sentences by topic increased significantly with age. A corresponding increase in the selection of theme related cues for recall was also found. Older children were more likely to select a representative from each of the three themes. Danner concluded that children's understanding of passage organisation, its detection and understanding of its potential usefulness for recall all developed with age.

Brown and Smiley (1977) have also examined the development of understanding of prose organisation. In this study the relative importance of sentences was the organisational factor of interest. They asked children aged eight, ten, twelve, and eighteen years to rate the importance of sentences in text using a procedure of progressive elimination. They then compared ratings obtained with previously acquired independent ratings (made by adults and thirteen year olds) of importance on the same text. The study found a strong developmental trend with a significant increase in sensitivity to levels of importance with age. Eight and ten year olds were unable to identify the most important units in text. Subsequent free recall tests indicated that all subjects recalled those sentences they rated as important. The authors concluded that this may result in subsequent poor study habits in which children, unable to correctly rate importance, focus on the less important aspects of text.

In summary, studies indicate that whilst children develop understanding of the principles of quantity at an early age, the understanding of the principles of relatedness and organisation develop throughout the primary school years and beyond.

Strategy Variables

Strategy variables are concerned with the methods used both in encoding and in retrieval. Essentially, they are concerned with the way task and personal variables are brought together in practice. Choice of appropriate strategy requires both the identification of those task variables most pertinent to the task at hand and knowledge of one's own ability. Studies have examined the development of strategies in a variety of situations. Two broad categories of strategy are discussed here: those examining strategies specific to learning and problem-solving strategies.

Knowledge of Learning Strategies

In the Brown and Smiley study (1977) young children's inability to identify the importance of information in text resulted in inappropriate studying strategy. The eight and ten year olds focussed on less important aspects of the text. A subsequent study has further examined the development of strategies used in studying text (Brown and Smiley, 1978). In two initial studies, adult patterns of studying text were examined. It was found that adults were efficient in recalling the story gist and when given additional study time concentrated selectively on those aspects identified as important. In a final study, the strategies of children aged ten, twelve, sixteen and eighteen years were compared with those found for adults. The results indicated that the primary school-aged children (aged eight and ten years) were less able to identify important units of text and were not efficient in the use of extra study time. Given extra study time these children did not use the selective attention strategies employed by adults. The effects of study strategy were reflected in poorer subsequent recall.

Brown and Smiley (1978) also noted the use of note taking and underlining strategies during the study. They report that many of the older subjects in the study spontaneously used such strategies. For the younger children this was less evident. Of the ten year old sample only 6% took notes. Underlining was more prevalent with this group. The nature of the underlining strategy of the ten year old children was further investigated. The level of importance of the text underlined by those identified as spontaneous underliners was compared with that of the remaining children who were instructed to underline. It was found that whilst spontaneous underliners distinguished the most important text, those induced to underline did not discriminate between text of varying levels of importance in underlining. The effect of strategy was reflected in free recall responses with spontaneous underliners showing a more adult-like pattern of recall.

Forest and Waller (1981), report similar development of adaptive strategies in reading. They examined the strategies of good and poor readers in the age range eight to twelve years, given different task purposes. The children were asked to read stories for four different purposes: fun, to make up a title, to find a specific piece of information as quickly as possible and study. They report that older and better readers were more likely to expend additional effort on the more demanding tasks. Further, they attended selectively to relevant parts of the text.

Problem-solving

The Kreutzer et al. study (1975) examined the strategic responses of children of five to eleven years to everyday problems. Two questions were concerned with the child's prior preparation for later recall: one question was concerned with remembering an object (remembering to take skates to school) whilst the other was concerned with remembering an event (a birthday party). Responses to both these questions indicated that children become increasingly planful with age. The use of external cues (notes, physical placement of objects), for example, was far more frequently suggested by older children in the sample. Other studies have also found this to be the case (Fabricus and Wellman, 1983).

Two further questions in the Kreutzer et al. study (1975) were concerned with the strategy used in retrieval. Again, one was concerned with an object (a lost item of clothing) and the other with retrieval of an event (remembering which year a dog was given as a Christmas present). In both, planfulness of retrieval was found to increase with age. Responses to the question concerned with retrieval of a lost item, for example, ranged from such non-strategic responses as "look everywhere" to specific strategy responses such as retracing where they had been or a priority ordered search. Incidence of the latter type of response was found to increase with age. Similarly, planfulness increased with age in the retrieval-event problem. With age, the use of reconstructive approaches in which the child used direct or indirect cues increased. The youngest children in the sample were found to have difficulty with the item. Of those who did respond the most common response for younger children was to ask the help of others. In contrast many of the older children suggested "working it out" by doing a mental search. For example, one of the eleven year olds suggested

> *Think of all the Christmases he was in and think of all the gifts he had gotten and then he would finally think of the Christmas he got it* [the dog] (Kreutzer Leonard and Flavell, 1975, page 40)

In summary, research examining both learning strategies and solution of problems indicates that with age both quantitative and qualitative changes in strategy knowledge occurs. Firstly, the child's repertoire of strategies increases. Secondly, the child becomes more aware of the salient task features and directs strategy to these. A refinement of strategy is evidenced.

1.2.3 The Development of Metacognitive Processes

The pattern of development described by research reviewed here is one of increasing regulation. Firstly, with age the child evidences greater planfulness and strategic behaviour in his or her approach to cognitive tasks. In the Kreutzer et al. (1975) series of questions concerning preparation for recall and retrieval strategies, for example, five year olds typically gave non-strategic, "*try everything*" responses. When asked how they would retrieve a lost item these children frequently suggested an exhaustive search - "*look everywhere*". In contrast, nine and eleven year olds proposed more strategic, ordered search responses such as "*retrace my steps*". Secondly, with age responses became increasingly internal. A trend of development from behavioural to mental responses was evidenced. In studies of verbal comprehension, for example, older children recognised a verbal instruction as inadequate before following it through, whilst younger children did not. Markman (1977) has proposed that this is because older children mentally represented the act and thus recognised the inadequacies before acting. In the Kreutzer et al. study, similarly, responses to a number of the questions evidenced a greater reliance on mental rather than behavioural strategies with age. The question which asked the child to provide strategies for retrieval of an event (which Christmas a dog was given as a present) is a good case in point. Responses to this item were categorised into three broad groups: Note, Others, and Self. The first two categories represent behavioural strategies: one looking for external evidence, the other asking significant others. The third category, in contrast, is concerned with mental strategies - working it out. The proportion of responses falling into this latter category increased significantly with age. Thirdly, with age the child has more personal control. A common development in many of the Kreutzer et al. (1975) questions, for example, was from an "other" (getting someone else to remember) to "self" (work it out myself) response.

A number of models have been proposed to summarise the pattern of development of metacognitive processes described here. Brown (1975) has proposed that the development of metacognition proceeds through two stages from episodic to semantic. The metacognitive functioning of the young child she suggests is episodic. That is, it is specific to the task at hand. The child gradually refines behaviour at this level, however, and becomes increasingly more strategic within the given context. At a later stage the child's metacognitive knowledge becomes more integrated and less context bound. The child, through association of specific metacognitive experiences, develops broader metacognitive principles. Once again, these are gradually refined and become increasingly more strategic. Hagen, Jongeward and Kail (1975) present a similar thesis. They suggest that with age the depth at which cognitive tasks can be processed increases because the network of associations between individual cognitive experiences broadens and becomes more greatly regulated. Like Brown (1975), they propose the process of metacognitive development is one of increasing refinement. They suggest further that, with age and experience, those aspects of learning which are more salient change as the learner's understanding deepens. Brown and Deloache

(1978) have developed this point. They have drawn parallels between the stages of metacognitive development and those occurring in the transition from novice to expert. They suggest metacognition proceeds from a state of no regulation through conscious regulation to automatic regulation. As one aspect of learning proceeds to this final stage another becomes the focus. Finally, drawing on the work of Vygotsky (1978), a number of theorists point to the development from other to self-regulation with age (Wertsch, 1979; Kopp, 1982; Brown et al., 1983).

The common theme in these accounts of the development of metacognition is the contention that it is a process of progressive refinement and integration of knowledge. As Hagen et al. (1975) concluded:

> *Changes in memory between the ages five through eleven are a consequence of the child's gradual acquisition and mastery of sophisticated mnemonic strategies. Changes in memory performance with age reflect the development of an ever expanding repertoire of strategies rather than a shift in the fundamental bases of cognition ... The child plays an increasingly active role as deeper levels of analysis are reached. With development these deeper levels are more often employed to increase the probability of retention. In addition the network in which children encode information becomes richer.*
>
> (page 96)

1.3 PROBLEMS AND ISSUES

The problems and issues presented by the field of metacognition are both conceptual and methodological. The extent of the field is not clearly defined and the methods employed in its examination have to date been largely unsystematic.

1.3.1 Problems of Definition

Wellman (1983) has described metacognition as a *"fuzzy concept"*. Indeed, whilst it is theoretically distinct, in practice the parameters of the field are not clear. The range of cognitive phenomena included under the umbrella term *metacognition* is extensive. As a consequence, those phenomena taking the title metacognition may be only loosely related. Wellman (1983) states

> *... different processes all of which take part of the original distinction (metacognition) may be related only loosely to one another. Thus the term ... serves primarily to designate a complex of associated phenomena.* (pages 3-4)

The need for greater clarity is apparent. In the present study, this has been achieved by restricting the scope of metacognitive phenomena considered to that of metacognitive knowledge and strategies (see Section 1.1.2). The need for a long term solution to the problem of clarity is, however, acknowledged. For further discussion of this issue the reader is referred to Brown et al. (1983).

1.3.2 Problems of Measurement

Research data obtained from the study of metacognition are largely dependent on verbal reports. Whilst it has been suggested that reaction time could be used as a measure of metacognition (Cavanaugh and Perlmutter, 1982), the majority of studies have employed verbal assessment methods in the form of independent reports (e.g. Kreutzer et al., 1975, interview study) or concurrent studies where the verbal reports relate to an on-going cognitive activity (e.g. Danner, 1976; Tenney, 1975). Indeed, the need to assess qualitative as well as quantitative developmental changes render this necessary. The problems inherent in verbal reports are well documented (e.g. Danzinger, 1980). They present a particular problem to developmental studies like the present one. The possibility that the child's ability to express metacognitive knowledge is limited by his or her verbal capacity and, further, that this factor may inflate developmental differences is evident. The problem is, however, largely unresolvable.

A number of critics of metacognitive research (e.g. Cavanaugh and Perlmutter, 1982; Schneider, 1985) have suggested that the impact of measurement problems can be reduced by using multiple measures for assessment. Whilst the inherent problems of verbal assessment cannot be overcome, the use of a variety of verbal methods will strengthen the reliability of the data. Following a review of research methods in the measurement of metacognition, Cavanaugh and Perlmutter (1982) conclude

> *a better alternative ... is to use multiple assessment techniques that provide converging measures of variable interest ... Judicious combinations allow the researcher to capitalise on the strengths and avoid the pitfalls of each separate method.* (page 20)

The present study acknowledges these recommendations. It employs multiple measures of metacognition in an attempt to assess the level of metacognitive functioning of children in the age range seven to eleven years.

1.3.3 THE STATE OF CURRENT RESEARCH

Though some current change in approach to metacognitive research is reported (e.g. Robinson, 1983; Brown et al., 1983), the body of extant research is largely unsystematic. Metacognitive research has typically followed one of two research paradigms: developmental or training. Both types of study have tended to examine metacognition specific to a particular task. Moreover, they have largely remained at the level of demonstration. With one notable exception (Kurtz, Reid, Borkowski and Cavanaugh, 1982) reliabilty and validity of these studies have not been established.

Nor has the relationship between different metacognitive measures employed by these studies been examined.

The Stability of Metacognitive Measures

There is a dearth of research addressing the issue of the reliability of metacognitive measures across time. In the review of literature examining metacognitive development the author found only one study which examined the reliability of metacognitive measures.

This study (Kurtz et al, 1982) examined the reliability of four measures: a subset of items from the Kreutzer et al. interview study (1975), serial recall, categorisation and memory monitoring (Predicting ability). A test-retest paradigm was used with an interval of six weeks between the two test occasions. The results revealed, with the exception of serial recall, a significant correlation between the test and retest metacognitive scores with individual correlations ranging from 0.30 to 0.49 and the composite battery correlation being 0.67. On the basis of these findings, the authors concluded that these measures were reliable.

Clearly, further work is required to establish the reliability of other commonly used metacognitive measures. In the present study, some of the items tested for reliability in the Kurtz et al. study (1982) are employed. However, for some of the measures employed such information was not available.

The Relationship Among Metacognitive Measures

As a consequence of both the problems of definition and the approach taken in metacognitive research to date, little is known about the relationship between metacognitive measures. Research has typically examined individual aspects of metacognitive knowledge specific to particular tasks. Whether metacognition is a general concept or domain-specific thus remains at question.

At a theoretical level the models proposed by Brown (1975) and Hagen et al. (1975) provide some unity to the available research in metacognition. Research has not, however, empirically examined the relationship between different measures. The degree to which metacognition is general or specific requires investigation. This issue is of particular importance if multiple measurement of metacognition is to be used to assess metacognition and further predict cognitive performance.

The Relationship Between Metacognitive Measures and Cognitive Performance

Studies have examined the predictive validity of the concept by examining the relationship between measures of metacognition and cognitive performance.

Kurtz et al. (1982), for example, in a study subsequent to their reliability study, examined the validity of the four measures. They examined the extent to which metacognitive scores on the measures predicted transfer and the generalisation of a trained strategy in a novel learning situation. Children were trained in the use of an elaboration strategy. The transfer of this strategy to a new task presented one week later was assessed. It was found that the children's scores on the metacognitive measures correlated with strategy versus non-strategy use. Those children who had higher scores on the four metacognitive measures were significantly more likely to use the strategy in a novel situation than children who obtained a low score. Further, it was found that the metacognitive measures more effectively predicted strategy transfer than IQ measures. Kurtz et al. (1982) concluded that the results supported the validity of the four metacognitive measures. The measures predicted the use and transfer of strategic behaviour and were superior in this respect to measures of general intelligence.

Other studies have also examined the relationship between performance on metacognitive measures and metacognitive behaviour. The results have been inconsistent, however. Cavanaugh and Perlmutter (1982), following a review of research in the field, concluded that such studies only indicate a low or moderate relationship between metacognitive measures and behaviour. They state, however, that this is due to poor research rather than flawed hypotheses. They suggest that the use of a single index of metacognition in many studies is one explanation for the poor results. Again, they call for multiple methods of assessment in metacognitive studies.

Another explanation for the apparent weak relationship between measures of metacognition and behaviour is that the learners in many of the studies considered have not seen the value of strategies in which they have been trained. Flavell (1981) has indicated that the child must not only have metacognitive knowledge but must see its value before it will be employed. A growing body of literature indicates that the provision of a rationale for strategy use enhances strategy transfer following training (Cavanaugh and Borkowski, 1979, 1980; Ringel and Springer, 1980). Wellman (1983), in a review of research examining the relationship between metacognition and cognitive performance concludes that when these studies are taken into account a picture of a strong relationship between the two emerges.

In the first stage of the present study, the relationship between different measures of metacognition is investigated. Using correlational and factor analytic techniques the degree of association between different cognitive measures is assessed. In the second stage of the study, the relationship between metacognitive measures and one cognitive behaviour - attribution for learning outcome - is examined.

1.4 SUMMARY

Metacognition is concerned with the knowledge and control of the cognitive domain. The research documenting the development of metacognition is extensive. It is not unified, however. Typically, it has examined metacognition specific to a particular task. Studies have examined the child's knowledge and strategies pertaining to personal, task and strategy variables. The general pattern of metacognitive development is one of increased sophistication and refinement with age. Greater internality and self-control is also evidenced.

A number of problems and issues are raised by the concept. Firstly, the range of behaviours which can be termed metacognition is not distinct. Secondly, the method of measurement, which necessarily entails verbal reports, presents problems of reliability. Finally, the reliability and validity of current measures of metacognition is not yet established.

The nature of metacognition requires further investigation. Whether it is a unitary concept or specific to task domain is not clear. Nor is the relationship between metacognitive measures and other aspects of cognitive behaviour established.

CHAPTER 2

A CRITICAL REVIEW OF THE APPLICATION OF ATTRIBUTION THEORY IN THE CLASSROOM SETTING

2.1 COGNITIVE THEORIES OF MOTIVATION

The child's understanding of his or her learning outcome has been identified as having a significant influence on subsequent achievement behaviour (Covington, 1983; Covington and Omelich, 1984; Weiner 1974, 1979). It is the premise of cognitive theorists (eg. Rotter, 1954; Crandall, 1963; Weiner, 1979) that achievement motivation behaviour is not simply the product of internal drive (Freud, 1949; Hull, 1943) or external rewards (Skinner, 1953) but is mediated by a largely rational process in which the learner's past experience and the value of the outcome are considered. The child is thus portrayed as an active agent in determining his or her own achievement behaviour. The present study works within this framework of cognitive motivation theory. It examines one such theory - Weiner's application of achievement motivation in schools (Weiner, 1972, 1974, 1977, 1979, 1983, 1984).

2.2 WEINER'S THEORY OF ATTRIBUTION FOR LEARNING OUTCOME

2.2.1 THEORETICAL PROPOSALS

The study of attribution for learning outcome is the study of responses made by children to the question "why did you succeed or fail?". These responses are termed causal attributions for success or failure.

According to Weiner (1979), when the outcome of an achievement orientated task (typically defined as Success or Failure) is known the child will seek a causal explanation for it. The cause ascribed is indicative of the child's understanding of his success or failure. Different causal attributions, he proposes, have different psychological effects. Thus, differences in attributions following a learning outcome explain individual differences in motivation and emotional reaction.

2.2.2 ATTRIBUTION TYPES AND ATTRIBUTION DIMENSIONS

Following Heider (1958), Weiner has suggested that four attribution types are the most relevant to the achievement context[1] : Ability, Task Difficulty, Effort and Luck. Each of these is classified using the dimensions internal versus external (locus of causation), stability versus instability, controllability versus uncontrollability.

The idea of locus is derived from the earlier works of Heider (1958), Rotter (1954), Crandall (1963), and de Charms (1968). It is concerned with whether the cause ascribed is located within self (internal) or outside the self (external). It is an index of the degree of responsibility taken for the learning outcome and as such relates most closely to self-esteem: the reinforcement value of the outcome. Maehr (1974) suggests that for an individual to experience pride in success or shame in failure, he must attribute outcome to internal causes and further that such perceived control is essential for achievement striving. Attribution to Ability and Effort in Weiner's framework indicates internality of attribution whilst attribution to Luck and Task indicates externality.

The stability dimension concerns the extent of endurance of the cause to which learning outcome is ascribed. Stable attributions are those seen as long-term, whereas

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[1] Weiner (1979, 1983) does, however, point out there are many more valid attribution types which might be examined.

unstable attributions are those seen as short-term or changeable. Weiner suggests that Ability and Task attributions are stable whilst Luck and Effort are unstable causes. The dimension of stability relates to expectancy and more specifically expectancy shift: the change or adjustment in expectancy following performance feedback. Its effects are on achievement motivated behaviour. A stable attribution indicates that the cause of the outcome is largely unchanging. Change of expectancy and consequently of behaviour is unlikely to occur following a stable attribution, at least not in a productive way. In contrast, attribution to unstable causes indicates that the situation is seen as changeable and subsequent behaviour should change, contingent upon feedback information.

Where outcome is ascribed to a cause which is both internal and unstable, for example *Effort*, productive behavioural change can be brought about. The individual can utilise feedback to improve subsequent performance. If cause is conceived as external, however, the possibility of such productive change is reduced. For this reason, Weiner depicts attribution of learning outcome to Effort as a "healthy" productive choice.

The dimension of controllability has been introduced to the theory more recently (Weiner, 1979). It was a response to criticism that the theory did not account for situational variables. The dimension is a development of the notion of intentionality (Heider, 1958) and is indicative of the degree to which the child perceives control over the learning outcome or, conversely, sees it as inevitable and therefore out of his or her control. To illustrate this distinction: a child may attribute failure to mood or state of health which, although internal to self, are out of his or her control. At present, uncertainty surrounds the placement of the four attributes - Ability, Task Difficulty, Effort and Luck - along this dimension. Nor has the theory developed a clear proposal regarding the psychological effects accruing from controllable versus uncontrollable attributions. There would appear to be some overlap with the stability dimension and effects are more likely to be related to motivational behaviour.

Attribution to controllable causes is likely to bring about subsequent contingent behaviour whereas attribution to uncontrollable causes is not.

A further dimension for the classification of attributions - that of globality - has been proposed by Abramson, Seligman and Teasdale (1978). Its concern is with the generalisation of the cause ascribed. Thus, any cause may be seen as specific to the situation or as having general applicability. Ability attributions, for example, may be a specific skill or factual piece of information, or a general factor affecting all achievement endeavours. Again, whilst it is to some extent distinguishable, this dimension has some overlap with that of stability.

2.3 EMPIRICAL TESTING OF THE THEORY

Weiner's theory has provided a valuable framework through which to examine motivation in the achievement context. Whilst it has been the subject of varied criticism (discussed later in this chapter), the considerable volume of research it has generated since it was originally proposed (1972) bears witness to its value in this respect. Research in a wide range of motivationally based fields has provided considerable empirical support for the proposals.

A large body of research has been concerned with explaining individual differences in achievement motivation behaviour by examining attribution styles following success and failure experiences. Early research by Weiner and associates (Weiner and Kukla, 1970; Weiner, Neirenburg and Goldstein, 1976) reinterpreted the dispositional model of motivation proposed by Atkinson and associates (Atkinson, 1958; Atkinson and Feather, 1966) and successfully demonstrated that differences in achievement behaviour were associated with attributional style. Largely systematic results were found for the Locus dimension with high achievers attributing success to internal causes and failure to external causes. For low achievers, the opposite pattern emerged. Along the dimension of stability, the results were less consistent. Generally, however, the results indicated that high achievers attributed success to stable causes and most particularly to Ability, whilst they attributed failure to unstable causes and particularly Effort. For low achievers, the attributional styles again followed the opposite trend. Weiner has explained these common patterns in terms of an ego-enhancing/ego-preserving bias. Achievement-motivated individuals attribute cause to maintain a positive self-image, whilst low achievers attribute cause such that they maintain or even justify poor achievement. The reader is referred to Bowerman (1978), who provides a more detailed discussion of these processes.

More recent research has endeavoured to establish a causal link between achievement behaviour and attribution for learning outcome by identifying the antecedents and consequences of different patterns of attribution.
Most notable in this field is the body of research concerned with learned helplessness (Seligman, 1975; Dweck, 1975; Abrahamson, Seligman and Teasdale, 1978). Briefly, learned helplessness is a state of reduced motivation (learning depression) brought about when the individual believes the outcome of his learning endeavours is not contingent on his learning behaviour. It is characterised as a condition common to low achievers who have experienced repeated failure (Sabatino, 1982; Canino, 1981). It has also been proposed that non-contingent success amongst high achievers may result in a similar condition (Seligman, 1975; Thorpe, 1985).

A study by Dweck and Repucci (1973) has experimentally demonstrated learned helplessness. In this study, subjects were administered a series of soluble tasks by one experimenter and insoluble tasks by another experimenter. Following several such trials the "failure experimenter" administered soluble tasks. Subjects, however, had difficulty solving these tasks even though they had shown the ability to do so when they had been administered by the "success experimenter". Dweck and Repucci concluded that subjects behaviour varied as a function of their perceived control.

Within the classroom, such processes may also be seen to occur. Ruble and Boggiano (1980), for example, draw parallels between the Dweck and Reppucci demonstration of learned helplessness and observations of selective deterioration in class. Seligman (1975) suggests this may be why some children perform badly in one subject or with one teacher. Moreover, a series of studies by Dweck and associates, suggest that sex differences in achievement striving in school may be explained in terms of learned helplessness (Dweck and Gillard, 1975; Dweck, Davidson, Nelson and Enna, 1975; Dweck and Bush, 1976; Dweck, Goetz and Stauss, 1980). Dweck, Davidson, Nelson and Enna (1978) have associated differential styles of feedback given to boys and girls with their differing conceptions of cause. In an observation study, they found that teachers typically provided feedback to girls for good conduct or success whilst for boys the teachers attention was drawn more frequently to failure (error) situations for which the teacher provided informative feedback. Negative feedback for girls was infrequent. However, when it did occur, it was critical and attributed learning outcome to low ability. The style of feedback provided for girls served to dissociate learning behaviour from its outcome and thus produce a less motivationally facilitative pattern of attribution.

Butkowsky and Willows (1980) have examined the behavioural consequences of learned helplessness. They compared the behaviour of poor readers, who were described as helpless, with that of average and good readers. Subjects engaged in two tasks: one a reading task, the other a non-reading task. Reaction to failure and success on these tasks was assessed. Measures of expectancy, expectancy shift, attribution and motivational behaviour (persistence) were taken. The results revealed that the poor readers had a lower initial expectancy, were 40% less persistent than average or good readers following failure, and were more reactive to failure and thus reduced expectancy to a greater degree than average or good readers.. Poor readers attributions indicated they took more responsibility for their failure and less responsibility for success than average or good readers. Moreover, Butkowsky and Willows report a generalising effect of learned helplessness. The observed differences between poor readers and their average and good counterparts were observed for both reading and non-reading tasks.

Diener and Dweck (1978) have similarly compared children evidencing learned helplessness with those identified as achievement motivated (Mastery-orientated). They obtained verbalisation protocols from children as they engaged in a series of problem solving tasks. The results of the study indicated that children described as learned helpless make a greater number of spontaneous attributions. Furthermore, whilst achievement-orientated children used failure as an information source from which they could improve strategy, the learned helpless group progressively deteriorated in performance. The degree of hypothesis testing evidenced by this group was reduced and the number of irrelevant strategies increased with successive failures. Failure elicited a negative affective response in the learned helpless children, whilst for the achievement orientated it was a cue for changed, and indeed improved, cognitive performance.

On the basis of such findings, attribution retraining in which children identified as "learned helpless" have been taught to change their causal attribution has been advocated as a remediating procedure. Typically, reattribution studies have followed through the theoretical proposals of Weiner which indicate the virtue of Effort and have adopted a method in which children evidencing learned helplessness have been taught to attribute their learning outcomes to this cause. Dweck (1975), for example, used this procedure. She compared reattribution training with a behavioural programme in which the child experienced "success only". In the training condition, children experienced both success and failure trials. Following failure, outcome was attributed to Effort. The results indicated that, whilst both procedures improved performance, only attribution training was successful in achieving maintenance of expectancy and persistence in behaviour following failure on subsequent trials. Studies by Andrews and Debus (1978) and Craske (1988) present similar favourable reports of the efficacy of attribution training. Andrews and Debus report that the positive effects of reattribution transfer to new tasks. Craske (1988) examined the efficacy of reattribution training for two groups of poorly performing children: the first exhibited learned helplessness behaviour whilst the second exhibited "self worth" (ego-enhancing) behaviour in prior observations. She reports that attribution retraining - in which children are taught to attribute learning outcome to Effort - was effective in improving the achievement behaviour of those in the learned helplessness group but less so for those in the comparison group, who already possessed an ego enhancing attribution style.

Reattribution training provides a clear demonstration of the influence children's perceptions of the cause of their learning outcomes have on their subsequent learning behaviour. It is a logical progression from studies demonstrating association between attribution styles and achievement behaviour, through studies demonstrating the antecedents and behavioural consequences of causal attributions, to training remediating studies. Such research has generated great optimism that attribution may be the key to the understanding of children's achievement motivation in the classroom. Andrews and Debus (1978), for example, conclude from their reattribution study

> *attribution influences and may even cause behaviour in the classroom*
> (page 163)

The present study approaches such optimism with caution. Whilst acknowledging the value of the framework provided by Weiner's application of attribution theory to the school context, it recognises that it is still in a stage of development. The research to date, exemplified in the studies reported here, points to the potential of the Weiner's proposals. Most notably, they have demonstrated that the theory has direct applicability in the classroom. However, a large number of theoretical and methodological ambiguities remain.

2.4 PROBLEMS AND ISSUES

The general field of Attribution Theory from which Weiner's proposals are derived has been heralded as a psychological approach with applicability to a broad field of human phenomena at all levels of human functioning: intrapersonal, interpersonal, inter-group and societal (Hewstone, 1988). It is, however, based on a number of contentious assumptions:

1. That attributions made are necessarily "causal".
2. That individuals spontaneously seek causal explanations.
3. That it is possible to elicit causal attributions.
4. That attributions are an expression of the child's understanding of the learning outcome.

These assumptions underlie Weiner's proposals and it is these which have been focal issues in current research. The theory has been subject to various criticism:

1. That the concepts with which it works are not defined: specifically it does not distinguish between "cause" and "reason".
2. That it assumes attributions are spontaneously occurring but does not state when and under what conditions attributions occur.
3. That it is based on a model of adult reasoning and fails to account for the effect of development.
4. That it fails to account for the effect of situational variables.

5. That the method of elicitation of attribution may itself affect the type of attribution derived and that the classification of these attributions may not reflect the child's understanding.

A discussion of each of these issues is presented below.

2.4.1 REASON AND CAUSE

The issue of whether reason and cause are distinct entities or synonymous concepts has been a continuing issue addressed by philosophers (see for example Peters, 1958; Davidson, 1963). It has, however, been an issue overlooked by the majority of psychological research in the field of attribution theory. Most studies have been content to assume that all explanations offered for an outcome are causal.
It has been argued, however, that causes and reasons are distinct concepts and that many explanations for outcome fall into the latter category. Causes, it has been argued, are lawful links between action and outcome. They are logical and objective. Reasons, in contrast, have been defined as explanations of intentional actions and are subjective (Buss, 1978; 1979; Jones and Nisbett, 1972; Locke and Pennington, 1982).

An issue raised by this distinction is whether individuals are able to generate causal attributions for the outcome of their own actions. This issue has been the focus of debate amongst critics of attribution theory (Buss 1978, 1979; Kruglanski, 1979; Monson and Snyder, 1977; Locke and Pennington, 1982). It has been argued that, as an actor, the individual is not able to give causal explanation because cause necessitates objective observation. An actor can only provide subjective reasons. (Buss, 1978). However, this proposal has been refuted (Buss 1979; Locke and Pennington, 1982). Whilst there is agreement that reasons are solely the domain of the actor, it has been proposed that the actor may stand aside from the situation and also provide a causal explanation as an observer of his own actions. Subjective information, held by the actor, does not negate the existing knowledge of causal relations possessed but rather is additional to it. The present study takes this position.

The practical implications of this debate for attribution theory lies in the explanation of differences found between actors and observers (Jones and Nisbett, 1972). Their different points of observation and the different availability of knowledge are likely to result in different explanations of action. It follows that the two prominent methods employed in attribution research - hypothetical versus participant - will yield different results. Brown (1986) has found this to be the case. For the present study, it has an additional point of interest. The ability to view objectively one's own behaviour is a metacognitive skill. Nicholls has found that the child's conception of the learning context develops from one of subjectivity to greater objectivity with age and experience (Nicholls, 1978; Nicholls and Miller, 1984b). We may then be witnessing, in the study of children's attributions, a development from the explanation of learning outcome as *'reason'* to one where explanations are *'cause'*.

2.4.2 THE SCOPE OF CAUSAL ATTRIBUTIONS

The foundation of attribution theory is the contention that individuals spontaneously seek causal explanations for the outcome of their endeavours. Whilst problems of measurement render this contention difficult to refute, the theoretical integrity of this assumption has been questioned. Semin (1980) suggests that a major flaw of the theory is that it takes for granted that individuals ask the question *"Why?"*, without examining its aetiology. He states:

> *The theory gives rise to a serious ... shortcoming, namely it makes the man in the street a continuous "reality constructor". It is obvious that we do not construct social reality from scratch every morning when we get up: however, it is not clear in attribution theory* when *we make attributions and* when *we do* not. (page 297)

Kelley (1972), like Semin, proposed that individuals could not continually seek explanation for the myriad events around them. He proposed that individuals develop causal schemata based on their observations and experience of cause and outcomes. Thus, the issue becomes one of distinguishing when causal explanations are made and when causal schemata are employed. It is likely that only when causal schemata cannot accommodate a given outcome that a full causal explanation is sought (Kelley, 1972). Eiser (1983) proposes that attribution theory and attributional processes are reserved for situations which are otherwise unpredictable or difficult to explain. In the achievement context of schools, it is likely that such situations are those where expectancies are not realised and where failure occurs[2].

Wong and Weiner (1981) have examined the preconditions of attributional activity. In a series of five experiments, college students were presented with achievement context scenarios for which they were required to record any questions these evoked (self-probe methodology). The results indicted that failure and unexpected outcomes elicited the greater number of attributional questions although these were also evident for other circumstances. Frieze, (1976) reports similarly. Wong and Weiner concluded that the studies provided evidence that

> *individuals do make attributions when not specifically directed ... attribution is prominent in thought*
>
> (page 660)

That the study demonstrates the spontaneity of attributional activity is questionable, however. Firstly, the method used was indirect - hypothetical. Responses were to achievement scenarios, not directly experienced learning outcomes. Secondly, the self-probe method employed, whilst not explicitly directing subjects to make attribution, is likely to have pre-disposed them to do so. Finally, the college students in the sample are likely to have been sensitive to the requirements of the experiment.

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[2] Failure, in itself, is not necessarily a contravention of expectancy but, in the light of reported ego-enhancing biases, it is likely to generate an attributional search.

Perhaps a more satisfactory methodology with findings more pertinent to the present study is that of the previously reported study by Diener and Dweck (1978). In this study, the subjects were primary school children and the method one of recording the children's verbalised thoughts as they solved a series of related problems. Diener and Dweck (1978) report that the frequency of attributions was higher for children defined as learned helplessness and that this was particularly the case following failure. Achievement-orientated children made fewer mistakes and where these did occur they were not viewed as a failure outcome for which cause must be sought but rather as an informational cue: an integral part of the learning context. Chapman and Lawes (1987) similarly document the impact of unexpected and failure outcomes on attributional activity. They attained free response attributions following the results of the New Zealand University Entrance English exam from 388 students (84% of the total national sample for 1982). They report that, whilst all subjects made attributions, there was an outcome x expectancy effect. More divergent attribution patterns emerged following unexpected outcomes. The majority attributed their results to Effort. Those failing, however, attributed their results to Ability.

Together, the findings of Wong and Weiner (1981), Diener and Dweck (1978), and Chapman and Lawes (1987), indicate that attributions do occur spontaneously. They are more likely to occur, however, if expectancy is not realised or the outcome is a failure. Expected and, in the majority of cases, successful outcomes are accommodated by existing causal schema and the question *"Why?"* does not arise (Eiser, 1983; Kelley, 1972). The behaviour of mastery-orientated children in the Diener and Dweck study exemplify this process.

These findings raise two further issues relevant to the present study.:

Method of studying attribution

By demonstrating that attribution is a spontaneously occurring phenomenon, the findings provide justification for the study of attribution and its application in the achievement context of schools. They do, however, bring into question the method of studying attributions. The majority of attribution studies, including the present study, employ a method in which attributions are elicited. They ask the question "*Why?*" rather than observing spontaneously occurring attribution responses. As a consequence, the results obtained reflect existing causal schemata and in some cases ad hoc or tautological responses as well as causal attributions. Little, for example, reports that some children reason from the outcome to the cause: "*I succeeded therefore I must have tried*" (Little, 1985).

Identification and definition of success and failure

The findings point to the importance of the identification and definition of learning outcome. For attribution to be made, an outcome must firstly be perceived. The Diener and Dweck study provides a clear illustration of this point. Whilst some children defined an error in strategy as failure, others did not see it as an end point and thus did not stop to make an attribution.

Secondly, the outcome must be meaningful for an attribution to be made. Brickman (1978) has expressed concern about the phenomenological validity of attribution research. He argues that for attribution to be made, the outcome must be seen as real and have value for the child. In many studies, where outcomes are contrived or relate to tasks which have no value to the child, this may not be the case. Success and failure are subject to the child's perception of the task to which it refers. A study by Frieze, Snyder and Fontaine (1978) examined the differences between experimenter definitions of learning outcome and those of children. In this study, a sample of eleven year olds were asked to evaluate their performance on social science and maths tests. The subjective definitions obtained were compared with actual scores (objective success). The results revealed a correlation of 0.74. The authors point out that, whilst this is a high correlation, it is sufficiently below 1.00 to suggest that subjective ratings are influenced by other factors in addition to objective performance and definitions. Subsequent regression analyses indicated that subjects who actually performed well saw themselves as trying hard, whereas those who felt they were successful saw themselves as having high ability. Elig and Frieze (1979) found a similar discrepancy between subjective and objective definitions.

Finally, definition of success and failure are subject to the child's application of individual standards (Crandall et al, 1965) and social comparisons (Constanzo and Dix, 1983; Ames, Ames and Felker, 1977; Karinol, 1987; Ruble and Boggiano, 1980; Nicholls, 1975). Thus, whether the outcome of learning is defined as a success or failure is related to the development and application of individual standards and normative references. These issues are a major focus of the present study and are further discussed in Section 2.4.5. For an excellent review of these issues, the reader is referred to Frieze, Francis and Hanusa, (1983).

2.4.3 THE EFFECTS OF DEVELOPMENT

The process of attribution is described by attribution theorists as an active search for cause. It is a cognitive process in which the range of possible causes for an outcome are considered and a judgement made. Kelley (1967) likens the process to that of an analysis of variance (ANOVA) in which the individual considers competing hypotheses about cause. As such, attribution presupposes a sophisticated level of cognitive functioning. Firstly, it assumes an understanding of cause: principles of the relationship between action and outcome. Secondly, it assumes the ability to reason abstractly: to produce hypotheses about cause. These assumptions have called into question the applicability of the theory to child populations.

Cognitive developmental theory, particularly the work of Piaget and his school (Piaget, 1968) would suggest that children who have not yet reached the stage of formal operations are not yet capable of the "ANOVA-style" reasoning described by Kelley (1967). Children of primary school age, who are the focus of the present study, typically have not developed formal operations. The question of whether these children can actually make causal attributions is thus raised.

A large body of research examining the development of attributions for success or failure has been generated in response to this issue (Nicholls, 1975, 1978, 1979, 1984a, 1984b; Karabenick and Heller, 1976; Kun, 1977; Rholes, Blackwell, Jordan and Walters, 1980; Ruble and Rholes, 1981; Nicholls, Patashnick and Mettetal, 1986). Two broad approaches to the problem have been followed. The first is a descriptive approach: studies have aimed to describe developmental trends in preferences for attribution types and to identify when logical capacities emerge. The second is a comparative approach: studies have examined the causal attributions of children against the yardstick of adult performance.

Developmental Patterns

Of the studies describing the developmental patterns of attribution, very few have been concerned with the range of causes used by children to explain their successes and failures. However, a few such studies have been made (Bar-Tal and Darom, 1979; Little, 1985). The findings of these studies document that children employ a large range of attribution types in explaining their learning outcomes; Little (1985), for example, identified eighteen common attribution types used by children in the age range five to fourteen years. Of the four categories used by Weiner, only Ability and Effort were found to have a high frequency of use. Numerous studies report similarly that Ability and Effort are the most common attribution types employed to explain learning outcomes (Brown, 1986; Weiner, 1979, 1983, 1984). Further, the incidence of their use varies with age. Specifically, it has been found that, whilst all children emphasise Effort, there is an increase in attribution to Ability with age (Parsons and Ruble, 1977; Little 1985; Rholes, Blackwell, Jordan and Walters, 1980).

Many developmental studies have focussed on the way children relate Ability and Effort attributions, in an endeavour to identify the emergence of logical, causal reasoning. Using largely hypothetical methods, studies have examined how children of different ages utilise attributions of Ability and Effort in explaining success and failure outcomes. Highly systematic results are reported. They describe a developmental pattern of progressive differentiation of the concepts of Ability and Effort (Nicholls and Miller, 1984a). Young children, in the age range five to seven years, do not distinguish between Ability and Effort. Typically, they place emphasis on Effort and to "try hard" is to be able. Children of this age employ a principle of magnitude covariation in which effort and ability are seen as additive. In contrast, children in later primary school differentiate Effort and Ability. By late primary school, children use a principle of compensation. Effort and Ability are seen as reciprocally related. Thus, ability can compensate for poor effort and effort for low ability. Moreover, the principles employed are not unique to Ability and Effort attributions. Miller (1985) reports similar developmental patterns for noise and interest attributes. For a detailed discussion of such developmental differences, the reader is referred to Karabenick and Heller (1976); Kun, (1977).

The results of these studies suggest children as young as five years employ principles of cause in making attributions, though these may not be the same as those employed by adults. Comparative studies further examine this issue.

Adult - Child Comparisons

These studies have been concerned with the similarities and differences between the causal reasoning of adults and children. A study by Cauley and Murray (1982), for example, compared the causal reasoning of forty primary school aged children (seven to ten years) with that of forty adults. The children, as participant subjects, engaged in verbal learning tasks and experienced both success and failure (achieved through manipulation of task difficulty). They then responded to an open ended attribution interview. Adult subjects were asked to evaluate the effects of Ability and Effort on children's future success for the same task. Adult and child responses were compared. The results indicated that the children understood negation and reciprocal relationships between Ability and Effort attributions and use these consistently. Moreover, their responses were not significantly different from those of their adult counterparts. Cauley and Murray concluded that primary school age children are capable of causal reasoning and that their causal attributions are reliable.

The findings of the Cauley and Murray study are contrary to the predictions of the Piagetian model. The precocity of children's performance in the study, the authors suggest, is a function of the child's self-knowledge. The child, they propose, has greater familiarity with his or her own mental processes and thus attributions will be more advanced when making attributions for self than for others. An additional explanation may lie in the "concreteness" of experiencing the learning rather than observing and reasoning abstractly. A study by Shultz and Butkowsky (1977) provides support for this contention. They studied the causal reasoning of a group of five year old children. The children were presented an achievement scenario about which they were to provide causal explanation. For half the sample the scenario was presented verbally, whilst for the remainder the scenario was presented visually as a videotape. The results indicated that the children in the latter group made multiply sufficient cause inferences - a response pattern typical of adult reasoning - whilst the former group did not.

Together, the findings of Cauley and Murray (1982) and Shultz and Butkowsky (1977) demonstrate that children, like adults, have the capacity for logical reasoning about cause. However, they also draw attention to the importance of the conditions in which causal attributions are made. Greater familiarity and "concreteness" of presentation of the achievement setting clearly have an effect (*cf.* Donaldson, 1978). Fincham (1983), following a review of developmental literature, concludes that in the study of children's attributions:

> *The important question is not if children can think logically but under what conditions they do so.*
>
> (page 124)

2.4.4 Effects of Context

Attribution theory has been criticised for failing to account for the effects of situational and contextual variables in the ascription of cause (Semin, 1980; Jaspars, 1983; De Champs, 1983). As a cognitive theory it has typically focussed on intra-personal variables, particularly cognitive functioning. Evidence from developmental studies of attribution (discussed above), however, indicates that cognitive functioning provides only a partial explanation for differences in attribution amongst children. Children's attributions for success and failure were found to depend not only on the child's ability to engage in causal reasoning but also on the conditions under which attributions are made.

In the achievement setting of the school, both the broad social context and the specific learning context are likely to effect the salience of causal variables by structuring the stimulus environment (Taylor and Fiske, 1981).

Social Context

The classroom is a social environment. Children's individual achievement behaviours are carried out within a setting in which both the teacher and fellow pupils work to define learning outcome and explain its cause.

Teacher Definitions

Rosenholtz and Simpson (1984) suggest that many of the findings of developmental differences in children's attributions are a function not only of differing cognitive capacities but also of the differing social conditions experienced by children of different ages at school. Children in the infant school learn within a co-operative environment where teacher emphasis is on Effort whilst, in the later primary school, children learn within a more competitive school structure where ability is emphasised and normative comparisons made explicit. Rosenholtz and Simpson draw parallels between these teaching practices and reported developmental changes in attribution from Effort to Ability in the primary years. Constanzo and Dix (1983) and Eccles et al. (1984) make similar observations.

Pupil Definitions

Class peers provide an individual with a reference point with which to compare his performance and define his learning outcome. Levine (1983) suggests that such comparison is inevitable in the school context, which is pervaded with evaluation. Social comparisons have been shown to occur even when active efforts are made to prevent them occurring (Crockenburg and Bryant, 1978). In the absence of teacher-given definitions of success and failure, the child utilises social comparisons to gauge performance. Social comparisons are sources of information about one's own ability. Developmental differences in ability to make social comparisons are well documented (e.g. Nicholls, 1978; Jagacinski and Nicholls, 1982; Ruble, Feldman and Boggiano, 1976). It is argued that the ability to make social comparisons affects attribution and may explain documented developmental patterns of increasing attribution to ability with age. For a detailed review of the literature on social comparisons, the reader is referred to Levine (1983).

The Learning Context

Within the learning context, the qualities of the task, the learner's understanding of the task and the presentation of the task are all variables which influence attributions.

Qualities of the Task

Attribution theory has typically been concerned with explanations offered for individual outcomes or related groups of outcomes. It does not distinguish between different achievement settings. Weiner's application of attribution theory in school settings, likewise, does not address the issue concerning the effects of different tasks. Whilst task difficulty is amongst the four causal attributes with which Weiner is concerned, the effects of the task on the attribution is not considered in his proposals. Essentially, all tasks are assumed to have equal causal status. Qualities of the task have nevertheless been shown to influence attributions.

A study by Frieze and Snyder (1980), for example, examined the attributions of a group of primary school aged children (age range six to ten years) for success and failure on four different achievement tasks: school tests, athletics, artwork, catching frogs. The results indicated that the same children used very different attributions for success and failure across the four tasks. Attributions for school tests and art work were predominantly to Effort and Ability. Interest was also an important attribute for art work. Athletic pursuits and catching frogs were seen as more subject to external factors. Attributions for the outcome of these placed greater emphasis on factors such as Task Difficulty. Even very similar tasks have been found to have different attributional biases. A study by the present author, for example, found that the same children produced disparate patterns of attribution for learning outcome on two different problem-solving tasks: logical reasoning and anagrams (Thorpe, 1985). These biases suggest that attributions are not simply the result of causal reasoning but that there is some quality in the task which make certain attributions more likely. All achievement tasks do not start with equal status. In the Thorpe study, for example, the open-endedness of task solution for logical reasoning compared with the closed solution of anagram tasks explained attribution differences for success and failure for each (Thorpe, 1985). For different tasks, different features, which may be used to explain outcome, are more prominent.

Qualities of the Learner

The age and level of cognitive development of the learner has been identified by developmental studies as a variable influencing attribution for success and failure in achievement contexts (see Section 2.4.3). What the learner brings to a specific achievement situation has also been shown to have an effect. In the Frieze and Snyder study, the main effects found for achievement situation interacted with age and ability (Frieze and Snyder, 1980). The authors concluded that these differences reflected variable experience and familiarity with the tasks.

The familiarity of the task has long been known to have an effect on explanation of cause. The studies by Cauley and Murray (1982) and Shultz and Butkowsky (1977) (discussed in Section 2.4.3) demonstrated that when a task is made more familiar, through direct experience or concrete presentation, more advanced causal reasoning results. This is not simply a developmental phenomenon, however. It has also been found that when adults are presented with unfamiliar tasks, their level of causal reasoning is reduced (Ausubel and Schiff, 1954; Berzonsky, 1969, 1971). Attributions are therefore likely to vary as a function of learner familiarity with task. One explanation for this finding is that with greater familiarity the learner has a better understanding of the variables within a task and of those more likely to effect learning outcome. The learner with this knowledge may therefore attend selectively to those variables which are most likely to have a causal relationship with outcome. Interest and information about task importance have similar effects (Brown, 1975; Miller, 1976). This notion is like that of meta-attention described by Miller (1985).

Task Orientation and Learner Strategy

Information about the task - whether presented directly through instruction or indirectly through classroom milieu - has been shown to orientate the processing of a task (Nicholls, 1975; Nicholls and Burton, 1982; Miller, 1976; Wigfield, 1988). Achievement of a success or failure outcome is relative to task purpose and the individual adapts behaviour accordingly. The individual attends selectively and controls the level of processing in the light of information provided. Research in cognitive psychology clearly documents such adaptive processes (see, for example, Wessells, 1982; Spiro, 1977; Anderson, 1985).

Nicholls and associates (Nicholls 1975, 1983; Nicholls and Miller, 1984a) have suggested that the nature of an individual's engagement with a task will affect subsequent attributions for task outcome. Different task purpose directs different processing of the task, and structure the salience of causal attributes.
Specifically, Nicholls has identified two major orientations toward task. The first he terms ego-involvement. This occurs where the purpose of the task is a demonstration of ability: typically, test situations and competitive environments. The second he terms task involvement. This occurs when the task purpose is understanding or mastery. The two orientations are distinguished by the degree to which they differentiate the concept of ability. Within an ego-involvement orientation, ability is differentiated from other causes and is likely to be the focus of causal explanation for outcome. In contrast, task involvement does not differentiate ability. Qualities of the task and of the strategy used are more salient and are likely to structure causal explanations of outcome.

Studies comparing co-operative and competitive learning milieu provide support for Nicholls' proposals. The literature in this field is extensive (e.g. Ames, Ames and Felker, 1977; Johnson and Johnson, 1975; Johnson et al., 1981; Satterly and Hill, 1983). Typically, these studies have observed attribution for success or failure following a like task undertaken in either cooperative or competitive conditions. Manipulation of the milieu is brought about by presenting either different orientating instructions (eg Satterly and Hill, 1983) or differing reward structures (eg Ames, Ames and Felker, 1977). Whilst the specific nature of the effect reported is not consistent across studies, results consistently indicate that milieu does have an effect on attribution for success and failure.

An association between task orientation and motivation behaviour has also been reported. Butler (1988), for example, compared the effect of ego- versus task-involvement feedback on subsequent motivational behaviour of a sample of primary school aged children. The children engaged in a learning task under one of three feedback conditions: evaluative, task-related and evaluative plus task-related. Subsequent motivational behaviour (persistence, affective reaction) of the three feedback groups was compared. The results indicated that, whilst task-related feedback enhanced motivational behaviour, both the evaluative and evaluative plus task feedback undermined it. The study indicates that orientation can influence motivation.

Both the Butler study and the studies of classroom milieu have implied that the effect of context on attribution and motivation behaviour is mediated through differential cognitive processing. A recent study has attempted to directly manipulate processing and observe its effects on attribution for learning outcome (Wigfield, 1988). In this study, primary school aged children were instructed to verbally recall a tape-recorded story under one of two orientation conditions. In the first, emphasis was placed on the importance of remembering the story and the children were instructed to think of the task as a test. In contrast, in the second, emphasis was placed on understanding the story and subjects were instructed to think about the story as much as possible. Half the subjects in each orientation experienced success and the other half experienced failure. The results found no main effect for orientation.

Wigfield suggests that this result was attributable to a methodological flaw. In both processing orientations children had been presented with a general evaluative instruction which is likely to have directed both groups towards a "remember-test" processing pattern (*cf.* Butler, 1988). An interaction effect of orientation by age was found, however. For older children, the test condition enhanced internal attributions, whilst the understanding condition had the same effect for the younger children. This result most probably reflects previously reported developmental differences in the differentiation of the concept of ability (Nicholls, 1978; Jagacinski and Nicholls, 1982) and the possibility of the use of social comparison (Levine, 1983). Wigfield (1988) concludes that the study indicates that processing does affect attribution for learning outcome and calls for further research in the field with improved methodology.

The present study does, in fact, fulfil Wigfield's recommendations. It again examines the effects of processing on attribution. The method it employs takes into account the effect of evaluation. Here not only is the processing manipulated via instruction but the evaluation of performance is varied commensurate with the processing condition. Thus remembering is assessed by verbatim recall whilst understanding is assessed by questions concerning text content and meaning.

2.4.5 METHOD

Whitely and Frieze (1985), following a meta analysis of twenty five studies of children's attributions for success and failure, concluded that the research method has a systematic impact on the attribution patterns of children. The preceding discussion of problems and issues of attribution theory has made this apparent. The research context - the means of identifying and defining learning outcome and the methods employed to elicit attribution responses - have all been shown to have an effect.

The Research Context

The discussion of the effects of the different perspectives of actor and observer on attributions indicated the significance of research context. Hypothetical techniques in which the child is presented with achievement scenarios place the child in the position of observer. Such studies, whilst suitable for the study of the child's logical capacities in causal reasoning, do not have ecological validity. Only studies where the child is a participant in the achievement setting, as he would be in the classroom setting, has such validity. Put simply, to examine how the child understands his own learning, he must take the role of learner.

Likewise, the learning task selected for research must be a familiar school-based task if the results are to have ecological validity. The research discussed has indicated that the qualities of the task do have effect on subsequent attributions for their outcome. Many studies have presented children with tasks that are not familiar and not like those experienced in school.

In the present study, the research context has been selected to maximise ecological validity. Participant methods are used and the task presented is a reading comprehension task: a familiar school task commonly used in all three schools in the sample.

Definition of Learning Outcome

Methods used to define learning outcome in attribution research have also been shown to affect subsequent attributions.

The majority of studies define an end-point - an outcome - and as a consequence do not observe spontaneously occurring attributions. The studies are thus of attributions for all learning events not just those for which attributions would be made spontaneously.

In many studies, outcomes following learning are contrived. They are not, in fact, the result of the child's behaviour but rather of the experimenter's definition, based on the need for equal cell sizes. Such a method raises the issue of phenomenological validity. Whether the child sees the outcome as related to his actions becomes a methodological rather than a psychological issue.
Outcomes, whether contrived or naturally occurring, are typically defined by the experimenter as success or failure. Two issues are raised here. Firstly, the definition of outcome given by the experimenter may not concur with that of the learner. A number of studies report differences between subjective and objective definitions of success and failure (Frieze, Snyder and Fontaine, 1978; Elig and Frieze, 1979). Secondly, learning outcome may not simply be seen as "success" or "failure". It may be that learning outcomes, rather than being dichotomous, are continuous (Freize, Francis and Hanusa, 1983). If the child is utilising social comparisons or individual standards it may be that an outcome is a norm rather than a success or failure. There is evidence that children have both the capacity and the propensity to seek such normative references. Moreover, it may be that the experimenter definition of outcome does not accord with that of the learner. The child may evoke internal standards or social comparisons to define outcome.

In the present study, the definition of learning outcome is a major focus. The range of learning outcome definitions and the effects of definition source (experimenter versus self) are examined. Attribution in the study is made for learning outcome defined within two conditions. In the first, learning outcome is defined by the experimenter - the method characteristically employed by attribution research. In the second, the outcome is defined by the child. Open-ended questions asking children for their response to their performance are used to elicit outcome definition. A third category of outcome is introduced. For the experimenter-defined group, this outcome is defined as "average for age". For the self-defined group, this category represents all categories not defined as success or failure. The response of this group is of particular interest. Responses within this third category would indicate that children do not treat outcome as a dichotomous concept and will open to question the characteristic practice of attribution research which has depicted learning outcome as falling into two distinct categories: success or failure.

Attribution

The method of both eliciting attributions and categorising them into dimensions has direct consequences for the findings of attribution research.

Eliciting Attributions

Three broad categories of method for eliciting attributions have been employed by attribution research: structured unidimensional, structured ipsative and unstructured, open-ended (Maruyama, 1982). The structured unidimensional format typically presents the child with the four attributions - Ability, Effort, Task Difficulty and Luck - and asks them to select from these the variable that best explains their learning outcome. The structured ipsative format also presents the four attributes but requires the child to indicate the extent to which each factor contributed to the cause. An open-ended format, in contrast to these two, presents no causal attributes. It simply asks the child to provide an account, either written or oral, to explain their learning outcome.

Structured approaches have been the most commonly used in attribution research to date. Their ease of administration and of data analysis are advantages of the approach. An open-ended approach necessitates coding and is subject to the problems of coder error. The method does, however, allow for greater expression and specificity of the respondent. The three different methods of eliciting attribution have been shown to yield different attribution results. In particular, differences between open-ended and structured formats are apparent (Maruyama, 1982). Using confirmatory factor analysis, Maruyama compared the results of studies using each of these methods. The results indicated that the two structured methods yielded similar attribution dimensions but that these greatly diverged from those obtained by open-ended methods. Open-ended responses not surprisingly yielded more diverse and ego biased attributions.

This finding is likely to be a function of the differing levels of specificity of the structured versus open-ended formats. Structured attribution response formats are general. The responses they elicit are, therefore, categorical in nature rather than explicit. The range of causal attributes is given by the experimenter and the child is forced to utilise these as categories to express his belief about the cause of outcome. To illustrate, an attribution to Ability may refer to a specific skill relevant to the particular task at hand or to a general concept of ability. An open-ended format is specific. It allows for a greater range of attribution types and for idiosyncratic responses. Problems of classification are to a large degree overcome by this method. The respondent has a greater scope for expression and thus can make more clear the meaning of his or her attribution. Further, interview formats allow the experimenter to call for clarification if the responses are ambiguous.

In the present study, an open-ended interview format was used to elicit attributions. Using this method, assumptions about relevant attribution types were not required and the classification of individual attributions could be more accurate. Moreover, the interview format allowed the younger children in the sample to respond without restrictions of their limited writing and reading skills.

2.5 SUMMARY

Cognitive theories of motivation state it is not the outcome of learning itself that influences subsequent achievement behaviour but rather the learner's understanding of that outcome. Weiner (1972, 1979) has proposed that such understanding is manifest in attributions made for learning outcome. Whether the outcome is viewed as internal or external to self, stable or unstable, controllable or uncontrollable will have systematic effects on self-esteem and subsequent behaviour. These proposals have provided a framework which has generated a large body of research concerned with children's motivation in the classroom setting. Research findings have supported Weiner's contention that achievement motivation behaviour is mediated through the child's understanding of learning outcome and has demonstrated the direct applicability of the theory for instruction. It is still in a stage of development, however. A number of problems and issues are raised by the theory which require further clarification and investigation. Methods of investigation have been shown to influence the result of attribution research and the need to select methods appropriate to the research aim is noted.

The present study forms part of current research attempts to investigate and further refine Weiner's proposals. It examines two issues: the definition of learning outcome and the effects of processing on attribution. It is argued here that learning outcome is itself subjective. Whether the child's definition of learning outcome concurs with those given by external sources (experimenters, teachers, parents) is at question. An outcome defined by external sources may have a different meaning for the child and subsequently affect attribution. It is proposed that the level of processing affects the salience of particular attributes by structuring the learning context. Deeper processing (operationalised here as meaningful learning) will result in different attribution patterns from those following lower level processing (operationalised here as verbatim learning).

Moreover, developmental differences are predicted. Both attribution and metacognitive research documents age-related differences in the understanding of variables in the learning environment and within self. Different metacognitive knowledge, it is proposed, will interact with the definition of learning outcome and the effects of processing to influence attribution. These issues are further developed in Chapter 3.

CHAPTER 3

METACOGNITION AND ATTRIBUTION: DEVELOPMENTAL AND CAUSAL RELATIONSHIPS

3.1 INTRODUCTION

Most of the writers whose work has been reviewed in Chapter One conceive of metacognition as a set of structures by which the child develops an understanding of the process of his own memory and learning. It is assumed that the knowledge the child acquires permits him increasingly to "inspect" his own mental processes and become aware of his limitations as a processor of information. This awareness, in turn, enables the child to expand his repertoire of strategies for learning and to overcome the limitations imposed on him by memory capacity and function. Writers on causal attribution reviewed in Chapter Two on the other hand, though seldom using the concept of metacognition, see attribution behaviour as the child's subjective understanding of his learning as demonstrated by his explanations of reasons and causes of learning outcome. These explanations are explicitly elicited by questions such as "Why did you succeed/fail?" or are generated spontaneously as the child actively seeks an understanding of his attempts to learn and remember.

A conceptual relationship between metacognition and attribution seems clearly established. However, any empirical study of the relationship between two psychological constructs must consider the respective merits of at least four hypothetical "causal mechanisms". These are as follows:

(i) That the first variable is the cause or major determinant of the second;

(ii) That the second is the cause or major determinant of the first;

(iii) That the two variables are mutually dependent, as in a cyclical relationship;

(iv) That a third and underlying variable is the cause or major influence on the apparent relationship between the two variables.

A study of correlation, such as the present study, does not alone permit the relative probability of each "causal hypothesis" to be assessed since all would predict significant correlation coefficients. However, it is the argument of the thesis that on a priori theoretical and conceptual grounds hypotheses (i) and (iv) are more probable than hypotheses (ii) and (iii) in accounting for the relationship between the first variable (metacognition) and the second variable (attribution). Thus, it is proposed in this chapter that metacognition is the major determinant of attribution (and not vice versa) *or* that both metacognition and attribution are manifestations of an underlying developmental factor such as "psychological differentiation" (following Werner, 1957), "stage" (following Piaget, 1952) or "capacity" (Case, 1984, 1985; Baddeley, 1976).

The Developmental Hypothesis

Hypothesis (iv), the developmental hypothesis, will be weakened if an empirical relationship is found within age levels. However, if the relationship exists only across the age groups investigated, the probability of hypothesis (iv) being true is strengthened. Nevertheless, the working hypothesis that metacognition is the underlying developmental variable and attribution one of its partial manifestations is adopted during the initial stages of the present study.

The "Causal" Hypothesis

In seeking to explain attribution behaviour in terms of the child's metacognitive development, it is important to realise that it is highly unlikely to be the sole determinant. That is, knowledge of the child's level of metacognitive development (indexed here as a metacognitive score) will not provide a complete prediction of attribution type or dimension used. The context within which attribution is made will also have an effect. The child whose metacognitive score is high will not only have greater knowledge of how his own learning occurred and of possible causes of his learning outcome but will also be more able than his low scoring counterpart to apply his own criteria to define learning outcome if free to do so (experiments where the outcome is defined by the experimenter do not allow this). This argument implies that children who are more metacognitively developed will be better able to define learning outcomes which are consistent with various goals set by teacher or task - for example, immediate verbatim recall or long-term meaningful retention. Thus, the attribution behaviour will not only vary systematically with level of metacognition but also with the conditions under which learning outcome is defined (self versus other) and with the processing instructions which define the goals of learning and remembering (verbatim versus meaningful learning).

Before the formal research questions to be investigated by the study are set up, the following discussion will attempt to elucidate the nature of the relationship between metacognition and attribution behaviour as this emerges in the recent literature on the two constructs.

3.2 THE RELATIONSHIP BETWEEN METACOGNITION AND ATTRIBUTION

3.2.1 DEVELOPMENTAL COMMONALITIES

A number of recent studies have drawn attention to the relationship between metacognition and attribution. Miller (1985), for example, writes

> *a common feature of the two areas is that they both involve children's understanding of what factors affect mental events and overt behaviours*
> (page 208)

Indeed, a number of developmental commonalities are apparent:

Locus

For both metacognition and attribution the developmental trend described is one of increasing internality with age. Metacognitive research documents two such trends. Firstly, an increasing awareness of self as an active agent in learning is reported by Brown and Smiley, (1977, 1978), Forest and Waller (1981) and by Kreutzer et al. (1975). Secondly, an internalisation of learning strategy from behavioural to mental is reported (Kreutzer et al. 1975; Markham, 1977; Miller, 1985). Attribution research documents a similar shift in the locus of learning outcome and the nature of attributions. Firstly, with development the learner less readily accepts external criteria but rather employs personal criteria to define learning outcome (Frieze, Francis and Hanusa, 1983; Harari and Covington, 1981; Karinol, 1987; Nicholls, 1975; Ruble and Boggiano, 1980). This reflects the learner's increased activity. Secondly, whilst attributions have been found to remain largely internal throughout the developmental period with Ability and Effort the dominant explanations given for learning outcome, changes in the frequency of these two attribution types occur. A shift from Effort to Ability attribution is evidenced - mirroring the behavioural to mental shift in strategy reported in the metacognitive literature.

Stability

For both metacognition and attribution, the developmental trend described is one of an increasingly more systematic and integrated use of knowledge and experience. As a consequence, greater stability of response within and across learning situations is evidenced with age. Metacognitive research suggests a shift from an episodic, situation-specific functioning to that of a semantic, general approach (Brown, 1975;

Hagen et al., 1975). A corresponding development of principles of causality is reported in the attribution literature: from unintegrated, "magnitude covariation" to integrated "compensation" schema (Kun, 1977; Karabenick and Heller, 1976; Nicholls, 1983).

Of particular interest in this respect has been the development of the concept of ability. The more realistic understanding of ability, indexed by studies of predicting performance (Flavell et al., 1970; Yussen and Levy, 1975), has its counterpart in the greater differentiation and increased frequency of use of Ability as an explanation of learning outcome documented in the attribution literature (Jagacinski and Nicholls 1982; Nicholls, 1983). These parallels are clearly evidenced in studies such as that of Parsons and Ruble (1977) which describes children's more systematic use of feedback with age and subsequent more realistic shift from effort to ability attributions.

Control

The extensive metacognitive literature documents the acquisition and refinement of a wide range of strategies throughout the age range seven to eleven years. The availability of strategies and, with experience, their greater regulation presents the child with greater control of his learning environment. Control as a recently included dimension to Weiner's model has not been a major focus of research to date. Moreover, that research which has addressed the issue of control has largely been concerned with the child's perception of control in others (as in studies of morality: for example, Weiner and Peters, 1973), rather than in the child's understanding of his own control of learning. Nevertheless, there are indications that children's attributions reflect the increasing objective control provided by metacognitive development. Little (1985), for example, in his study of the range and frequency of attributions for learning outcome given by British school children, found that attribution to Strategy and Specific Ability increased with age.

Globality

Two processes pertaining to globality are evidenced in the metacognitive literature: generalisation and discrimination. Firstly, the greater integration of knowledge and experience postulated by Brown (1975) would indicate a greater globality with age. This is documented in the acquisition of a more realistic and general concept of ability and reflected in the increased attribution to Ability with age. Secondly, the child is better able to discriminate between different task demands and has an repertoire of strategies, increasing with age, to apply to these. We would thus expect attributions to reflect a greater specificity pertaining to task with age. Attribution research, following Weiner (1979), has not addressed the issue of globality. Further, the closed method of eliciting attributions in the majority of work has not allowed this. In the present study an open-ended method of eliciting attributions is used and classification of attributions along the dimension of globality employed. It is proposed that if attribution is directed toward Ability, greater globality will be evidenced but if attribution is directed toward Task, a greater specificity will be evidenced.

Developmental parallels described here indicate a monotonic relationship between metacognition and attribution. An increase in knowledge and regulation of learning behaviour coincides with increasing internality, stability and control. It is further proposed that globality will also reflect metacognitive development.

3.2.2 Empirical Studies of Association

The recognition of a relationship between metacognition and attribution is evidenced in recent research in both fields. It has been particularly evident in training studies

Reattribution Training Studies

Reattribution is concerned with changing the child's existing attribution style. Attribution to stable causes, particularly Ability, have been found to reduce motivational behaviour and increase negative affect (Weiner, 1979). Children are thus taught to attribute learning outcome to alternative causes. In a typical paradigm children experience a series of learning tasks. Following each, the desired explanation of learning outcome is given by the trainer. It is assumed the child will adopt as his own the explanation offered by the external source.

Initial proposals for reattribution training followed through the proposals of Weiner (1979) which emphasised the virtue of Effort attributions. Attribution to this unstable, internal cause, it was proposed, would facilitate motivation and subsequent learning behaviour. More recently, however, with the recognition of the importance of metacognitive processes, this position has been challenged. The low informational value of reattribution to effort has been criticised (eg Clifford, 1986a, 1986b, 1988). As an alternative reattribution to Strategy, in which failure is attributed to inappropriate strategy and success to appropriate strategy, has been advocated (Anderson and Jennings, 1980; Clifford, 1986a, 1986b, 1988; Kim and Clifford, 1988). Clifford (1986b) draws upon the work of Diener and Dweck (1978) to illustrate the differences between Strategy and Effort attributions. In this study, the mastery orientated children saw failure as error and use it as an informative cue to change strategy. Their subsequent motivational behaviour increased. In contrast, the children identified as learned helpless saw a single failure as an endpoint and initiated an attributional search. Typically, they attributed their failure to low ability and motivational behaviour decreased.

In a series of studies, Clifford compared the effects of Strategy and Effort reattribution training on subsequent behaviour and affect (Clifford, 1986a, 1986b). The results of the studies indicated that Strategy reattribution was more facilitative of persistent behaviour and elicited less negative affect following failure than Effort reattribution. Anderson and Jennings (1980) present similar favourable reports. They compared the effects of attributions to Strategy and Ability. Like Clifford (1986a), they found that Strategy attributions increased expectancy of success following failure whereas attribution to Ability reduced expectancy and subsequent motivational behaviour.

Implicit in the notion of reattribution is an acknowledgement of the link between metacognition and attribution. It represents an attempt to change the child's understanding of learning. It is argued here that it is a form of metacognitive teaching: reattributions instruct children in a principle of learning.

Recent studies in reattribution signify more explicitly the recognition of the attribution-metacognition link. They have directed the focus of attribution away from the affective and toward the cognitive domain. Whereas earlier reattribution studies (which advocated reattribution to Effort) were largely concerned with reducing negative affect of Ability, it has been proposed that Strategy reattribution is intended to promote self-monitoring, metacognitive processes (Clifford, 1986a, 1986b; Cullen and Carver, 1982).

Metacognitive Training

Metacognitive training studies have grown out of developmental findings. Typically, they adopt a research paradigm in which subjects are pre-tested to establish a baseline of metacognitive behaviour following which a training in metacognitive strategies is conducted. Post tests were then used to assess strategy use, maintenance and transfer to new tasks (e.g. Brown and Barclay, 1976; Brown and Campione, 1977; Brown, Campione and Murphy, 1979; Thorpe, 1982; Cox, Thorpe and Eley, 1983). The results of these studies were generally disappointing. Whilst strategy use and maintenance was attained, strategy transfer generally was not (Schneider, 1985).

One explanation for the failure to attain transfer was that training was insufficient (Thorpe, 1982, Schneider, 1985). Another is that the child failed to see the value of the strategy in which he was trained. A number of studies have investigated this proposal. They have combined metacognitive training with attribution and have provided a rationale for strategy use along with strategy training (Ringel and Springer, 1980; Reid and Borkowski, 1987). Subsequent results report more favourable transfer outcomes.

A recent study by Reid and Borkowski (1987) is a good case in point. In this study, hyperactive children in the age range seven to eleven years were trained under one of three conditions:

Strategy - children were trained in a specific organisational strategy only;

Strategy and Monitoring - children were trained in both a specific organisational and general monitoring strategies;

Strategy, Monitoring and Attribution - children were trained in Specific organisational and general self-monitoring strategies. In addition, they were trained via elaborative feedback methods to consider the causes of their learning outcome. Here emphasis was placed on strategy.

Training occurred over a period of six weeks following which an extensive assessment of training effects was conducted. Short-term maintenance of the training was assessed three weeks after training along with measures of self attribution and strategy generalisation. A long-term assessment followed ten months after training. This again included measures of self-attribution, strategy maintenance and transfer. In addition the child's cognitive tempo and behaviour and general metacognitive knowledge were assessed. The results indicated that the training which included an attribution component was the most effective. Children in this condition had significantly higher internal attributions for success and failure, were significantly more strategic and had higher general metamemory scores than children in the other two training groups. No differences in cognitive tempo between the three groups was found, however. In all three groups significant correlations between metamemory and attribution scores were found. The author's concluded that the combination of metacognition and attribution training influenced the durability of strategy in performance and also increased general metacognitive awareness.

The study underlines the close relationship of metacognition and attribution. The provision of a rationale along with metacognitive training (essentially a reattribution training) not only increased the effectiveness of metacognitive strategies but also perpetuated attributions for learning outcome more facilitative of motivation. With increased metacognitive knowledge (reattribution) and skill (trained strategy) the learner perceived greater control of learning. Similar findings are reported in an earlier study by Kurtz and Borkowski (1984). They report that

> *strategy use acquired during training sharpened metacognitive beliefs about the reasons for success and failure* page 351

Following metacognitive training these authors found that attributions to internal causes, particularly Strategy and Effort, increased.

In summary, an increasing awareness of the relationship between metacognition and attribution is reflected in the literature of both fields. Developmental parallels are apparent. A monotonic relationship in which developing metacognitive knowledge and regulation is accompanied by similar change in attribution is documented.

Training studies further indicate that metacognitive knowledge and regulation will be reflected in attribution for learning outcome.

A further proposal is that a causal relationship exists in which metacognition affects definition of learning outcome and salience of variables in the learning context which might explain learning outcome. This proposal is further outlined in Section 3.3 below.

3.3 METACOGNITION, ATTRIBUTION AND THE LEARNING CONTEXT

Brophy (1983), in a review of school based motivation literature, is critical of the approach taken in attribution theory. He suggests that research in the field has over emphasised the effects of Effort and Ability attributions and has failed to give sufficient attention to the child's understanding of the task itself. Indeed the child's understanding of the task and the context in which it is presented is central to both the definition of learning outcome and to its explanation. This is the focus of the second part of this chapter and of the empirical research conducted in Study Two of the present work.

Making an attribution entails three logical stages:

(i) Perceiving an outcome;

(ii) Defining the outcome;

(iii) Explaining the outcome.

It is argued that metacognition directs each of these processes.

3.3.1 PERCEIVING AN OUTCOME

For an attribution to be made a tenable endpoint must be perceived. Research has identified two metacognitive processes which influence the perception of a learning outcome: metacognitive monitoring and availability of relevant strategies.

Studies documenting the child's response to ambiguous or incomplete instructions reviewed in Chapter One (see Section 1.2.2.) indicate that with metacognitive development the child becomes increasingly spontaneous and more proficient in monitoring his own behaviour (Robinson, 1983). He more readily identifies a failure to understand. Identifying the failure to understand is prerequisite to identifying the cause. The cause sought may remain specific to the task and be concerned with strategy or may entail an attributional search in which the explanation extends beyond the task.

The availability of strategies for dealing with such problems, once identified, has been shown to influence how an endpoint is perceived. In the Diener and Dweck study (1978) mastery orientated children did not define an error as an endpoint but rather as a cue to adjust strategy. Cullen and associates (Cullen, 1985; Cullen and Boersma, 1982; Cullen and Carver, 1982) suggest that the availability of strategies to "cope" with problems in the learning situation will determine whether an endpoint - failure - is perceived. If a child has strategies available such an outcome is unlikely. If a child lacks strategies to cope with the learning situation, however, an endpoint of failure is reached and an attributional search initiated. In essence, what is proposed here is a relationship between metacognitive deficit and the definition of learning outcome as failure. In the absence of relevant strategies an early endpoint is reached.

Cullen and associates do not address the issue of how learning outcome is defined for those who do have sufficient metacognitive knowledge and strategies to complete the task. One may infer that the endpoint in these circumstances is determined by the completion of the task. Implicitly, completion is a successful outcome.

3.3.2. Defining the Outcome

The subjectivity of learning outcome has been outlined in Chapter 2 (see Section 2.4.2). Whilst ostensibly successful completion of a task is a "success" and failure to do so a "failure", the individual's interpretation of how he has performed may not accord with this objective definition. Nor will it necessarily accord with external definitions provided by teachers or experimenters. Personal or social standards may be employed to define learning outcome.

The use of personal and social standards to define learning outcome is reported to emerge with metacognitive development. With the acquisition of knowledge about the personal, task and strategy variables and greater experience, a shift from external to internal sources of outcome definition has been documented. (Frieze, Francis and Hanusa, 1983; Harter, 1981; Harter and Connel, 1984; Harari and Covington, 1981). Harter (1981), for example, has found "striking developmental trends" in the source (internal versus external) of learning definition. She has conducted extensive developmental studies in which both cognitive and motivational inventories were administered to children across the school age range. She reports:

> *The cognitive cluster - independent judgement versus reliance on teachers and internal versus external criteria - shows dramatic linear trends across the third to ninth grade. Scores for third graders are relatively extrinsic crossing the midpoint in the later Elementary grades into the intrinsic range... In interpreting these trends it seemed plausible that with increasing grade level children became more knowledgeable, more capable of making their own judgements and more able to determine whether they are successful.*
>
> (page 229)

The present study further examines the relationship between metacognitive development and the definition of learning outcome.

3.3.3 EXPLAINING THE OUTCOME

With the ability to apply his own criteria for defining learning outcome, the child is better able to define learning outcomes which are consistent with the goals of the learning task. Learning outcome is relative to the nature and purpose of the task. Firstly, different tasks have different objective requirements for successful completion: they require different Ability, Effort and Luck. Secondly, different task purposes influence the way the learner approaches the task. The learner may process the task in different ways and at different depths. The child's understanding of both the inherent qualities of the task, and the approach in undertaking the task, it is proposed, will effect the explanation given for learning outcome. These processes are outlined below:

The Salience of Causal Attributes.

Research discussed in Chapter Two (Section 2.4.4.) indicates that all task attributes do not have equal causal status. For different tasks, different attributes are more likely to explain outcome (Frieze and Snyder, 1983; Thorpe, 1985). In a similar way different task orientations increase the salience of different attributes. Nicholls, for example, suggests that the Ability is more greatly differentiated in a competitive than in a task orientated learning situation. More recently, Ames and Archer (1988) have reported systematic biases in attribution for learning outcome resulting from different task orientations.

There is some indication that the sensitivity to these task biases increases with age. Frieze and Snyder (1983) report a significant interaction between attribution for task type with age. They report that whilst attributions following success and failure for different tasks evidenced systematic biases across the age range studied (six to eleven), this effect was more evident with age. Both Nicholls and Jagacinski (1982) and Nicholls and Miller (1984a) report that younger children typically do not differentiate Effort and Ability concepts in different situations whereas older children and adults do. More recently, Wigfield (1988) reports an interaction between processing orientation and attribution for learning outcome with age. It is proposed here that the explanation for these developmental trends is the child's increasing metacognitive knowledge. With greater metacognitive knowledge the child is able to identify those variables most likely to affect learning outcome. As a consequence the probability of the employment of those attribution types most pertinent to a specific task increases with age.

Adaptive Strategies

With age the child is more able to adapt strategy to task demands (e.g. Brown and Smiley, 1977, 1978). Metacognitive research documents both an expansion and refinement of learning strategies with age. This presents the child with greater control over his learning (Cullen, 1985; Miller, 1985). At the same time, responsibility for learning becomes more evident. It is likely that attribution dimensions will reflect this development. Indeed, a number of studies report increasing control (intentionality) and internality of attributions with age (Freize and Snyder, 1980; Harter and Connel, 1984). Effects on Globality and Stability have not been addressed by the literature. However, it is proposed here that, as the child becomes more aware of the subtle differences between tasks, a greater specificity of response will emerge. The child, for example, can be more specific about the nature of the strategy used rather than simply indicating effort - *"I tried"*. In a similar way, if emphasis is placed on strategy, unstable attributions are likely to increase.

The processes of identification of salient attributes and adaptive strategies are examined in the present study. Here the effects of metacognition and age on attribution for learning outcome following a reading comprehension task are observed under one of two conditions. In the first, children are directed to process the task meaningfully. This direction is operationalised as a "learning for understanding" instruction. In the second, children are directed to process the same task superficially. This direction was operationalised as a rote learning, "verbatim recall" instruction.

It is argued that for successful completion of the meaningful task, links with existing knowledge are salient. Strategies of reflection, generalisation and elaboration are appropriate. In contrast, for successful completion of the superficial, verbatim task, memory capacity is salient and strategies of rehearsal are more important.

It is predicted that with age and metacognitive development these differences will be more readily distinguished and that these distinctions will be manifest in explanations provided for learning outcome. Specifically, it is predicted that whilst meaningful processing will result in greater attribution to knowledge, superficial processing will result in attribution to ability with age and metacognitive development. Further it is predicted that attribution will be more internal, controllable, specific and unstable with age and metacognitive development.

3.4 SUMMARY

The central thesis of the present study is that of a relationship between the child's level of metacognitive functioning and the explanations he gives for his learning outcomes. It is proposed that the child's metacognitive knowledge provides the informational standpoint from which he views his learning. It will largely determine both what he perceives (learning outcome) and how it is explained (attribution).

The empirical relationship between metacognition and attribution has not been systematically examined. There is evidence in the literature of each individual field of study of a number of developmental parallels, however. These may reflect the common, cognitive aetiology of both concepts or signify a closer relationship. Training studies point to an interaction between metacognition and attribution in affecting behaviour.

In the present study, a causal relationship between metacognition and attribution is proposed. Firstly, it is suggested that metacognition will influence the definition of learning outcome. The ability to monitor learning behaviour and the availability of strategies appropriate for task demands have been found to determine both the point at which a learning outcome is perceived and the extent of attributional search. Further, the criteria used to define a learning outcome change with metacognitive development. With increasing knowledge of personal, task and strategy variables, the child is more likely to apply individual standards to define learning outcome. Secondly, it is suggested that metacognition will largely determine the explanation for learning outcome. With increased knowledge about tasks, the child is better able to distinguish those attributes most relevant to successful completion of the task. It is proposed that these will be the focus of explanation of learning and will be manifest in attribution for learning outcome.

Specific research questions are presented in Chapter 4.

CHAPTER 4

RESEARCH QUESTIONS AND RESEARCH DESIGN

4.1 RESEARCH QUESTIONS

4.1.1 THE NATURE OF METACOGNITION

A preliminary aim of the present study was the selection of measures which would index metacognitive development. Whilst reviews of the metacognitive literature discussed in Chapter One advocate the use of multiple measures to increase the reliability of data, they do not indicate specifically which measures might be selected as criteria of metacognition. Such a decision must be based on the nature of metacognition itself which will be reflected in the relationship between measures. If metacognitive measures are highly correlated a general metacognitive factor is suggested and the selection of a small number of representative variables would sufficiently index metacognitive development. However, if low correlations are found it would suggest that metacognition is specific to the task on which the measure is based. An initial research question was thus

Research Question 1

What is the nature of metacognition?

(i) What is the range of responses within individual measures of metacognition? What is the relationship of variables within each measure?

(ii) What is the empirical relationship between metacognitive measures?

(iii) Which metacognitive measures are most representative of metacognitive development?

4.1.2 Attribution Type and Attribution Dimension

In contrast to the majority of attribution studies which employ closed methods to elicit attributions for learning outcome, the present study employed an open method. Children were simply asked "Why did you succeed / fail / get an 'average' score?" and were free to explain the outcome in their own terms. Additionally, many studies in attribution research are based on children's responses to hypothetical achievement situations or manipulations of the outcome of directly experienced learning. In the present study, children's attributions related to a direct learning experience and a genuine learning outcome. It was of interest to note the range of attribution type and dimension employed by children given the methods used in the study.

Additionally, the effects of age and learning outcome were examined. Attribution research documents systematic biases in attribution with age and outcome. It was of interest to note whether these biases were replicated in the present study given the methods used.

Research Question 2

What is the nature of attribution used by children in the age range seven to eleven years following a direct learning experience and given open response methods?

(i) What is the range of attribution type used?

(ii) Does the attribution type used vary with age?

(iii) Does attribution type vary with learning outcome?

4.1.3 The Relationship between Metacognition and Attribution

The primary aim of the study was to investigate the relationship between metacognition, as indexed by selected measures, and attribution for learning outcome.

An initial stage in this investigation was to examine the strength of the relationship using correlational procedures.

Research Question 3

What is the strength of the relationship between indices of metacognition and attribution type and dimension?

(i) *What is the strength of correlation between metacognitive indices and attribution type? What is the count of significant correlations?*

(ii) *What is the strength of correlations between metacognition and attribution dimension? What is the count of significant correlations?*

4.1.4 The Developmental Hypothesis

One relationship between metacognition and attribution hypothesised was developmental: that metacognition is a developing phenomenon which is expressed in attributions for learning outcome. The preference for attribution types and attribution dimension with age and metacognition were thus of interest:

Research Question 4

What is the developmental relationship between metacognition and attribution?

(i) *Does the use of attribution type vary with age and metacognition? And if so, in what way?*

(ii) *Does the use of attribution dimension vary with age and metacognition? And if so, in what way?*

4.1.5 The Causal Hypothesis: (A) The Effect of Metacognition on Definition of Learning Outcome

A second relationship between metacognition and attribution hypothesised is causal: that the child's level of metacognitive development affects his attributional behaviour in the learning context.

One manifestation of this relationship is the effect metacognition has on the definition of learning outcome. Research documents that with age the child more readily generates his own definition of learning outcome. It is suggested that the explanation for this finding is the underlying level of metacognitive development. With greater metacognitive knowledge, the child has a more realistic understanding of his own ability and is also able to identify those demands of a learning task which are central to its successful completion. It is thus proposed that the child, given the opportunity to define his own learning outcome, will increasingly employ his own criteria for this purpose with metacognitive development. The criteria employed to define learning outcome will, in turn, be reflected in attribution for learning outcome. Further research questions are thus

Research Question 5

What is the relationship between metacognition, locus of learning outcome (external versus self-defined) and attribution for learning outcome?

- *(i)* *What is the range of learning outcome definition when children are allowed to define learning outcome according to self-imposed criteria?*
- *(ii)* *Does the use of attribution type in explaining learning outcome vary with source of outcome definition (external versus self-defined)? And if so, in what way?*

(iii) *Does the use of attribution dimension in explaining learning outcome vary with the source of learning outcome definition (external versus self-defined)? And if so, in what way?*

(iv) *What is the effect of the level of metacognitive functioning on the use of attribution type for children in external versus self-defined outcome definition groups?*

(v) *What is the effect of the level of metacognitive functioning on the use of attribution dimension for children in external versus self-defined outcome definition groups?*

4.1.6 The Causal Hypothesis:(B) The Effects of Metacognition of Attribution Following Different Processing Orientations

A second manifestation of the causal relationship investigated is that of the effect of the level of metacognitive functioning on responses to different task orientations. A number of studies report age-related, systematic biases in the use of attribution type and dimension following different task orientations. The explanation for this, it is proposed here, is the child's increasing awareness of task demands which result from metacognitive development. It is suggested that with metacognitive development the child can better distinguish the salient attributes of a task. Moreover, with a greater range of strategies he can be more adaptive to task demands. These processes will be reflected in attributions for learning outcome. A further research question is thus

Research Question 6

What are the effects of task orientation on attribution for learning outcome?

(i) *Does the use of attribution type vary with task processing orientation? And if so, in what way?*

(ii) *Does the use of attribution dimension vary with task processing orientation? And if so, in what way?*

(iii) *What is the effect of age and metacognition on the use of attribution type following different task processing orientation?*

(iv) *What is the effect of age and metacognition on the use of attribution dimension following different task processing orientation?*

4.2 RESEARCH DESIGN

The examination of the relationship between attribution and metacognition took the form of two studies. The first was a developmental study which examined the nature of metacognition through observation of the performance of children in the age range seven to eleven on a variety of metacognitive tasks. Ultimately, the aim of this study was the selection of variables which would index metacognitive performance. Indices of individual metacognitive performance were then to be employed in the second study as an independent variable. The second study was experimental. It examined the relationship between metacognitive performance and attribution within a 2x2 design in which the definition of learning outcome (experimenter-defined versus self-defined) and type of processing (Verbatim versus Meaning) were the experimental conditions. The design is summarised in Table (1) below:

TABLE (1): SUMMARY OF RESEARCH DESIGN

Study One

A: Measurement of Metacognition

Aim	Investigation of the nature of metacognition based on a series of metacognitive measures
Observations	i. Individual consistency ii. Developmental patterns

B: Selection of Metacognitive Indices

Aim	Reduction and selection of variables as indices of metacognition
Selection Criteria	Distinctiveness of metacognitive measure

Study Two

Aim	Investigation of the effect of Outcome Definition and Processing on attribution for learning outcome
Design	2 x 2 design: Processing (verbatim vs meaning) x Outcome Definition (self-defined vs experimenter-defined) Dependent variables: attribution type attribution dimension Independent variables: age (7, 9, 11) metacognitive performance outcome (success, failure, "other")

CHAPTER 5

STUDY ONE: INVESTIGATION OF THE NATURE OF METACOGNITION AND SELECTION OF METACOGNITIVE INDICES

The study of metacognition fell into two distinct sub-stages. The initial stage involved an examination of the nature of metacognition. A series of metacognitive measures were selected and presented to children in the age range seven to eleven years. Results were examined for both individual consistency and developmental difference. The second sub-stage entailed the selection of metacognitive indices, which would best distinguish individual difference in metacognitive performance.

In the selection and preparation of the measures a series of pilot studies were conducted. These are detailed below.

5.1 PRELIMINARY INVESTIGATION AND PILOT STUDIES

5.1.1 SELECTION OF METACOGNITIVE MEASURES

Since an examination of the nature and measurement of metacognition was not the primary aim of the study, it was decided that, as far as possible, existing measures of metacognition would be utilised. The starting point in the development of indices of metacognition was thus a review of the literature.

A diverse range of metacognitive measures was reported in the literature, most very narrow in definition. Moreover, the majority of these were initiating empirical studies. Few had been examined in terms of their reliability or validity. A selection of possible measures was nonetheless derived from "central instances" of metacognitive measures in the existing research, using the following criteria:

Age of the sample: all studies selected reported results for subjects within the age range five to twelve years.

Method of measurement: whilst the aim of the present study was to utilise a range of metacognitive measures, it was decided from the outset to eliminate those studies in which metacognition was primarily measured via responses to hypothetical problems. Flavell and Wellman (1977) have distinguished between metacognitive knowledge and metacognitive production. It was felt that hypothetical techniques would measure only the former. It was of concern here to measure both knowledge and production particularly as later, in the second experimental study, metacognitive measures were to be linked with a directly experienced task as opposed to a hypothetical learning task.

Availability of reliability and validity data: studies for which some reliability and validity data were available were clearly to be preferred. One such study was found. An interview study by Kreutzer et al. (1975) had later been examined for reliability (Kurtz et al, 1982).

Nine studies were selected which detailed measures that fulfilled these criteria and thus indicated potential to act as indices of metacognition. From these, six measures were derived:

1. Kreutzer, Leonard and Flavell (1975) - a fourteen item interview study which presented a range of metacognitive problems.
2. Tenney (1975) - a word list generation task which examined organisational principles.

3. Flavell Fredreichs and Hoyt (1970), Markham (1973), Yussen and Levy (1975) - predicting ability on a serial recall task.
4. Yussen and Levy (1975) - predicting recall readiness.
5. Danner (1976) - organisation of prose.
6. Brown and Smiley (1977a, 1977b), Brown and Deloache (1978) - extraction of main ideas from text.

Two of these studies - Kreutzer et al (1975) and Tenney (1975) - were not taken directly but rather were adapted from the original study. Only a sub-sample of six problem items were taken from the interview study of Kreutzer et al (1975). The questions selected were those that presented problems directly, rather than through a third person, in keeping with the criteria set out above. The Tenney study - which asked subjects to generate word lists given cue words - was altered to the extent of providing new cue words. Tenney had used only one set of cue words for all age groups in her study. It was felt that there was a risk of confounding language knowledge with metacognition in using this procedure. Three separate age-graded cue word sets were generated using Lorge-Thorndike word lists (Lorge and Thorndike, 1952).

A further measure was specifically written. Flavell and Wellman (1977) had suggested that

> *a reasonable test of a child's mnemonic understanding ... would be to have individuals rate the ease and difficulty of tasks that vary on a combination of variables ... for example a series of memory situations could be presented ...*
>
> (pages 22-23)

Such a test was not found in the existing literature and so a measure specifically focussing on judgement of task difficulty was produced.

A series of pilot studies was conducted to assess and refine the measures.

5.1.2 Pilot Study One: Selection and Refinement of Metacognitive Indices

Subjects:

Fifteen pupils attending an urban Bristol primary school took part in the study. Five children from each of three class groups - top infants, second year juniors, and top juniors - were selected randomly by their class teachers. Ten subjects were female, five male.

Procedure:

Each child worked individually with the experimenter over two sessions, each of which lasted approximately 20-30 minutes. The study was split into two sessions as it was felt that fatigue effects were likely if all the measures were presented in a single session. During these two sessions the children were presented with all seven measures. The order of presentation both within and across the two sessions were randomised. All results were recorded: the interview study based on Kreutzer et al (1975) on audio tape and all others in written format.

Results:

Though no detailed statistical analysis of the results was made, descriptive summaries indicated that the tests were satisfactory to the extent of providing a range of scores. The pilot test indicated, however, the need to reduce the number of measures and to make administrative changes.

The study revealed that one measure - prose summary (Brown and Smiley, 1977) - was inappropriate in terms of time-demand for all subjects and task-demand for the youngest age group. It was thus decided to eliminate this measure. It also became apparent that two measures - Predicting Ability and Predicting Recall Readiness (Flavell, 1970; Yussen and Levy, 1973; Markham, 1975) - were confusing to the children, because they were very similar, and also redundant in terms of their separate administration. It was decided therefore to collapse these into one task for which two measures were taken. Finally, some adjustments to language were made and the need to give more explicit instructions noted.

To assess the revised metacognitive indices, a second pilot study was conducted.

5.1.3 Pilot Study Two: Further Selection and Refinement of Metacognitive Indices

Subjects:

Ten children from a First school and five children from a Junior school, both situated in an urban area of Dorset, participated in the study. Five children from each of three class groups - top infant, second year juniors and top juniors - were selected by class teachers. The teachers opted to select children from the top end of the ability range due to a reported positive skew in ability within the school. Teachers claimed selected subjects would be of "average" ability in a normal population. Examination of school records supported this claim. All children fell within the 96 - 118 IQ range on a group administered test and had reading ages within the appropriate range for age (Neale, Schonell). Nine subjects were female, six male.

Procedure:

Each child worked individually with the experimenter in one session of approximately 30 minutes duration. The child was presented with all five measures during that period. The order of presentation of the measures was randomised and, where repeated measures were taken, the order of items within each was also randomised.

Results:

Despite adjustments made to the Predicting Recall Readiness and Predicting Ability measures following pilot study one, problems of administration and interpretation of the results of these measures remained. It was therefore decided to drop these measures from the study.

All other measures were satisfactorily administered. However, it was found that one measure - which required the use of an interview technique (based on the interview study of Kreutzer et al 1975) - was disruptive to the flow of administration of the measures if, due to randomisation, it was placed in the middle of the battery of measures. It was therefore decided to forgo complete randomisation by placing this measure only at the beginning or end of the sequence of measures.

Examination of substantive results for each measure indicated that three of the four remaining measures were satisfactory. Each produced a range of scores. There was, however, need to further revise the task written by the author, Judging Task Difficulty.

Originally the Judging Task Difficulty measure had fifteen items (five task types x three items). Examination of responses to the first category of items - which required children to judge between two memory sets of different size - suggested there was a possibility that some subjects were basing their judgement on the order of presentation of the two memory sets rather than on the number of words in each set. It was therefore decided to add a further item to balance this set. Thus, there were four items: two in which long sets were presented first and two in which long sets were presented second. The last two categories of items, which varied more than one difficulty factor, were dropped because of the problems encountered in interpreting results. Thus, nine original items remained and a further one was added making a total of ten items.

Amended metacognitive measures were again pilot-tested.

5.1.4 PILOT STUDY THREE: FINAL REFINEMENT AND ASSESSMENT OF INDICES

Subjects:

Six children from an urban Bristol primary school participated in the study. Two children, one boy and one girl, were randomly selected by the experimenter from each of three class groups: top infants, second year juniors and fourth year juniors.

Procedure:

The experimenter worked with each child for a single session of approximately 20-25 minutes duration. All four measures were presented during the session; the interview was presented either at the beginning or at the end of the session and the other measures were randomly presented.

Results:

In all cases the administration of the indices was satisfactory. Children responded well in each case and the time limit of 25 minutes was found to be adequate. It was decided, however, that it would be advantageous to question the children regarding their *rationale* for selection on the Judging Task Difficulty Measure. This would remove the need for inference based on a one-out-of-two choice where the probability of a correct score due to chance was high.

Four indices were thus selected for the main study:

1. Generating Strategies (Kreutzer et al., 1975)
2. Organisation of Prose (Danner, 1976)
3. Word List Generation (Tenney, 1974)

4. Judging Task Difficulty (written by the author based on the suggestions of Flavell and Wellman, 1978)

Full details of these are presented in the description of the main study.

5.2 THE MAIN STUDY: STUDY 1A - MEASUREMENT AND EXAMINATION OF METACOGNITION

5.2.1 SUBJECTS

144 children drawn from three Bristol primary schools took part in the study. This sample comprised three age groupings of 48 children from each of three class groups: third year infants (mean age 6 years 8 months; range 6 years 4 months to 7 years 7 months); second year juniors (mean age 8 years 9 months; range 8 years 4 months to 9 years 7 months); fourth year juniors (mean age 10 years 6 months; range 9 years 9 months to 11 years 3 months). These groups are referred to as the seven, nine, and eleven year age groups, respectively.
Of this sample, 72 children were male and 72 female: 24 of each sex from each of the designated age groups.

5.2.2 MATERIALS

Examination of metacognition and subsequent selection of indices were based on four measures derived from the pilot studies:

Generating Strategies (GS)

This was an interview with items drawn from the interview study of Kreutzer et al (1975). The interview presented six problems concerning issues of learning storage and retrieval. For two of these questions stimulus materials - an example text and a word list - were used. The interview schedule and stimulus materials are presented in Appendix 1.

Organisation of Prose (OP)

This was adopted from the work of Danner (1976). It consisted of a set of one title and twelve sentences which together made a prose passage about "The Fox". The sentences contained three distinct organisational themes (i.e. 3 themes x 4 sentences): habitat, diet and physical appearance. The title and each of the sentences were mounted on separate cards. The test materials are reproduced in Appendix 2.

Word List Generation (WLG)

This was modified from the work of Tenney (1975). Three age-graded versions of each measure were prepared. Each was presented as a six-page booklet. On each page a cue word and four spaces, for generated words, were printed. Collation of the booklets was randomised. Test materials are reproduced in Appendix 3.

Judging Task Difficulty (JTD)

The test material consisted of ten word list pairs which were individually presented. The ten pairs comprised three task sets for which the dimension of task difficulty was varied:

Set One: for this set the number of items in the word list pairs was varied. Four word list pairs were included in this set. In two the longer sentence was placed in the first position and in the other two the longer list was placed second.

Set Two: for this set the semantic relatedness of the items was varied. Three word list pairs were included in this set.

Set Three: for this set the meaningfulness of the item was varied. Each list pair contained a simple word list and an embedded list within a sentence. The embedded words were designated by box highlights.

Test materials are reproduced in Appendix 4.

5.2.3 PROCEDURE

Subjects worked with the experimenter over a session of 20-30 minutes duration. In each session the metacognitive measures were administered: the generating strategies interview was presented at the beginning or the end of the battery of measures whilst the other three measures were randomly ordered. The procedure for administration of each test was as follows:

Generating Strategies:
The six interview questions were presented to the subjects and tape-recorded. In each case an exhaustive list of strategies was sought. Standardised probe questions were used to this end.

Organisation of Prose:
The twelve sentence cards were shuffled and placed out randomly. Subjects were told that the sentences "*went together to make a story about 'The Fox'*". At this point the title card was placed in front of the subject and the instruction given to put the sentences together to make the story in a way which "would be easiest to learn and remember". When the subjects had completed ordering the sentences they were asked to read it through, reminded of the purpose of ordering and invited, if they so

wished, to make any final changes. The ordering of the sentences was then recorded. Subjects were then questioned about their rationale for the order they had selected. This procedure was intended to ascertain if the subject recognised the themes. Specifically, it was a check for the possibility that the themes were recognised but not used by some subjects.

Subjects were then told they would have to remember the story and were asked to select three sentences they could keep with them as cues for recall (*"to help you remember all the story"*). The choice made was recorded.

Word List Generation:

Subjects were provided with age-appropriate booklets and were instructed to make a list using the word given and four of their own words. It was stressed that the list was to be remembered at a later time and therefore in making the list they should make it *"easy to learn and remember"*. Subjects from the eleven and nine year age groups wrote their own responses into the prepared booklets. They were assisted with spelling by the experimenter if this was requested. Because of the possible restrictions imposed by handwriting and spelling skills, responses for seven year olds were dictated to the experimenter who wrote the responses.

Judging Task Difficulty:

Subjects were told they would be shown ten cards and that on each one there would be two lists. They were instructed that their task was to indicate, by either pointing or saying "top" or "bottom", which would be the easiest to learn and remember. Examples of each of the three task sets were shown and additional explanation given of task set three where embedded lists were presented. The subjects were told they were required to learn and remember only the words in the boxes and were then presented with the cards in a random order. After each choice was made, the subjects were asked *"why is that easier?"* and responses were recorded.

5.2.4 Scoring

Responses for each of the Metacognitive measures were coded, scored and checked for reliability. The procedures employed in these processes is described below.

Generating Strategies

The scoring of the Generating Strategies measure involved three stages:

1. transcription of tapes
2. breakdown of transcribed protocols into units which were to be scored
3. categorisation and scoring

1. *Transcription of tapes*

A complete transcription of every utterance made during the testing session was not made. The subjects general "chatter" was omitted from the written record made of the tapes. All utterances relating to the solution of the problem were transcribed verbatim. Each strategy was recorded separately. Strategies were linguistically defined. Breaks in discourse or language markers (eg."another way would be" or "or you could") were assumed to indicate the end of one strategy and the beginning of another.

2. *Breakdown*

Originally, categorisation and scoring was to relate to linguistically-defined strategies. Initial attempts to devise a categorisation system, however, pointed to the inadequacies of this approach and indicated the necessity of an intermediary stage. It was found that younger subjects might produce the same content over a larger number of strategies than older subjects who presented more cohesive responses and, therefore, fewer strategies. It was thus decided to examine two variables. The original, linguistically-defined strategy was retained but, additionally, each strategy was examined in terms of individual Move units which were defined as

> *A mental or physical act relating to the solution of the problem which can be carried out in its own right.*

Essentially, Strategy provided a measure of cohesion / co-ordination whilst Moves were a measure of content. It was thus the latter variable which was categorised and scored for qualitative differences.

An intermediary stage before coding then was to breakdown each of the strategies into Move units using the above definition.

A reliability check was made on this procedure. A sub-sample of twelve interview protocols - four from subjects in each of the three age groups - were broken down into Moves by a second coder and an inter-coder agreement calculated. Results indicated a 93% agreement for the sample over all six problems. This was deemed an acceptable level.

3. *Categorisation and scoring*

For each of the six problems presented, a hierarchy of responses was devised and numerical scores awarded. These were based on results reported in the original study. Details of scoring hierarchies for each of the six problems are presented in Appendix 5.

Reliability checks were made for categorisation of the six problems using the scoring hierarchies. Again, interview protocols for a sub-sample of twelve subjects - four from each age group - were scored by a second coder and percentage agreement calculated. Results indicated a 92% agreement over the six problems. The range of agreement for each problem separately was 82-100%.

In summary, three groups of variables for each of the six generating strategies problems - a total of 18 variables - were examined in the analysis of responses.

The six problems were coded GSA to GSF and the suffix M, S, or HS attached to signify Moves, Strategies or Highest Score variables respectively:

1. Number of Moves (GSAM, GSBM, GSCM, GSDM, GSEM, GSFM)
2. Number of Strategies (GSAS, GSBS, GSCS, GSDS, GSES, GSFS)
3. Highest Score (GSAHS, GSBHS, GSCHS, GSDHS, GSEHS, GSFHS)

Organisation of Prose

The scoring procedure for this measure was taken from the work of Danner (1976). Responses were categorised according to sentence groupings. A hierarchy of four response categories was derived which ranged from "unorganised" to perfect organisation of four sentence groupings based on the four themes. Numerical values were assigned to each of these categories.

In the present study, as an extension to Danner's procedure, subjects have asked the rationale for their organisation. These responses were used to indicate theme recognition. For this variable, a dichotomous scoring system was employed which simply indicated whether the subject did or did not recognise the presence of themes.

The theme selection task, in which subjects were asked to select three sentences as cues for recall, was scored similarly. Subjects received a score if representatives of each of the three themes were selected. Details of scoring are presented in Appendix 6.

In summary, the three variables were examined:

1. Organisation of Sentence by theme (OS)
2. Theme Recognition (THR)
3. Theme selection. (THS)

Word List Generation

Scoring was an adaptation of the procedure used by Tenney (1976). Like Tenney, it examined the principle of organisation employed in generating the word lists. In addition, however, the scoring system incorporated a measure of the degree of cohesion of the list generated.
In establishing a scoring system for Organisation, a number of systems were pilot-tested. The initial intention was to have a complete ranking of all responses. This was not a viable method however. Examination of the responses revealed that many children, in fact, used different principles concurrently. Moreover, it was often difficult to make judgements between some principles of organisation in terms of their metacognitive sophistication.

The final scoring procedure employed a three-tiered hierarchy of responses. Each tier represented qualitatively different level of metacognitive performance for which different scores were assigned. Within each level a number of different organisational principles were grouped. These were awarded the same score and, where organisational principles were used concurrently, scores were cumulative.
Details of scoring are presented in Appendix 7.

Scoring was checked for reliability. A sub-sample of responses of 18 subjects - six from each age grouping - were scored by a second scorer and the results examined for percentage agreement. Over the total sample, agreement for the scoring of Organisation was 96%. The range across age groups was 87-100%. This was deemed satisfactory.

In summary, two groups of variables were derived from this measure:

1. Principle of Organisation (GRAPHIC, PHONIC, FUNCTION, DESCRIPTION, CATEGORY)
2. Cohesion (CO-ORDINATED, SPECIFIC CO-ORDINATED)

Judging Task Difficulty

Two variables derived from this measure were examined. Firstly, the list selection from each of the ten list pairs was noted. Secondly, the rationale given for each selection was categorised and assigned a score. List selection was scored on a dichotomous scale with selection of those lists previously designated as being the easiest to learn being awarded one point.

Responses to the question regarding rationale for list choice were categorised into four groups: no rationale, inappropriate rationale, alternative rationale, standard rationale. These were ranked hierarchically. Inappropriate and standard rationales were based on principles used to write the items: number, relatedness, meaningfulness. Alternative rationales were appropriate, non-standard rationales. Details of scoring are presented in Appendix 8.

The scoring of rationale was checked for reliability. Responses of a sub-sample of 15 subjects, five from each of the three age groupings, were categorised by a second coder and the results compared for percentage agreement. A 93% agreement was found.

In summary, two sets of variables were derived from this measure:

1. Selection of list (SITEMS)
2. Rationale for selection (RITEMS)

5.3 RESULTS: METACOGNITIVE MEASURES

All data were analysed using SPSSX statistical computing package (1986).

5.3.1 Generating Strategies

Consistency

Correlation studies were conducted to investigate:

1. Consistency of variables - the relationship between Moves, Strategies and Highest Score *within* each of the six tasks.
2. Consistency of response - for like variables Moves, Strategy and Highest Score *across* the six tasks.

Consistency of Variables

To examine their relationship, Moves, Strategies and Highest Score variables within each of the six tasks were correlated. Results are reported in Appendix 9. Results reveal a positive and significant relationship between Moves, Strategies and Highest Score within each task.

To examine whether any developmental differences in the relationship between Moves, Strategies and Highest Score occurred within a task, correlations were repeated for each age group separately. Results are presented in Appendix 10. Results indicate there is a developmental difference. For seven year olds, positive and significant correlations between the three variables were maintained. For nine to eleven year olds, however, Moves and Strategies did not correlate significantly with

Highest Score in either case. For these age groups the qualitative (HS) and quantitative (M and S) variables become separate.

Consistency of Response

To examine the consistency of responses across the six tasks, Pearson's correlation coefficients were calculated for like variables. The results are reported in Appendix 11 and the number of significant correlations summarised in Table (2).

TABLE (2): SUMMARY OF THE NUMBER OF SIGNIFICANT CORRELATIONS OF LIKE VARIABLES ACROSS SIX GENERATING STRATEGIES TASKS

	Move	Strategy	Highest Score
Number of significant correlations	15	9	7
Total	15	15	15
Percentage significant	100	60	47

Results reveal a positive and significant correlation of Moves across all six tasks and indicates a high consistency of response. For Strategy, 60% and for Highest Score 47% of correlations were positive and significant. These results well exceed the level of correlation expected by chance and indicate a moderate degree of consistency across the six tasks.

Pearson's correlations for like variables - Moves, Strategy and Highest Score - were calculated for each of the age groups separately to examine the possibility that correlations across the whole sample were an artefact of developmental difference. The results are presented in Appendix 12 and summarised in Table (3).

TABLE (3): SUMMARY OF THE NUMBER OF SIGNIFICANT CORRELATIONS OF LIKE VARIABLES ACROSS THE SIX GENERATING STRATEGIES TASKS BY AGE GROUP

Age	Number of significant correlations		
	Moves	Strategies	Highest Score
7	4	3	0
9	9	4	5
11	8	0	2
Total	21 (47%)	7 (16%)	7 (16%)

The results indicate that the total sample correlations were partially a product of developmental difference. Whilst individual scores for Moves remained the most consistent, the percentage of significant correlations was reduced by more than half. Consistency for Moves was greatest for the nine years age group. For Strategy only 20% of correlations for seven and 27% for nine year olds were significant whilst for eleven year olds no significant correlations emerged. This result indicates that all subjects, and particularly eleven year olds, were responding differently to different tasks in generating strategies. The results for the Highest Strategy variable point to a similar conclusion. For this variable only 16% of correlations attained a level of significance.

Development

In order to investigate the relationship between age and the six Generating Strategy tasks a series of one-way analyses of variance for each of Moves, Strategy and Highest Score by age were carried out. Additionally, non-parametric measures of association suitable for row x column ordered contingency tables were calculated. In this respect, the Gamma measure was appropriate (Leech, 1979). This measure was employed to supplement the ANOVAs since there was concern that the assumptions of homogeneity of variance and of normal distribution on which ANOVA is based may not have been fulfilled.

The results are reported below.

Moves:

The results of the analysis of variance by age and associated gamma values for each task are presented in Table (4).

TABLE (4): MEAN NUMBER OF MOVES, F VALUES AND PROBABILITY OF F FOR THE ANALYSIS OF VARIANCE OF MOVES FOR GENERATING STRATEGIES TASKS BY AGE AND ASSOCIATED GAMMA VALUE

	TASK					
AGE	1	2	3	4	5	6
7	2.29	1.94	2.12	2.52	1.60	2.00
9	2.96	2.81	2.67	3.19	2.08	2.90
11	2.92	2.75	2.48	3.28	2.00	2.87
F value (df 2,143)	4.652	9.518	2.764	5.883	2.948	4.301
p	<0.01	<0.001	n.s	<0.01	n.s	<0.05
Gamma	0.24	0.36	0.14	0.27	0.17	0.26

The results indicate significant age effects on four of the six tasks. Examination of the cell means reveals a non-linear pattern of development with seven year olds generating the smallest number of moves in each case and, in the majority of tasks, nine year olds the highest. Gamma results are likely to be reduced by the non-linear pattern. They do ,however, provide confirmation of F values.

Strategies:

The results of the analyses of variance for Strategy by Age for each of the six tasks are presented in Table (5).

TABLE (5): MEAN NUMBER OF STRATEGIES, F VALUES AND PROBABILITY OF F FOR THE ANALYSIS OF VARIANCE OF STRATEGY FOR THE GENERATING STRATEGIES TASKS BY AGE AND ASSOCIATED GAMMA VALUE

	TASK					
AGE	1	2	3	4	5	6
7	2.21	1.79	1.92	2.40	1.50	1.91
9	2.19	2.42	2.37	2.65	1.92	2.37
11	1.83	2.31	2.04	2.51	1.79	1.98
F value (df 2,143)	2.496	6.785	2.954	0.952	2.401	3.762
p	n.s	<0.01	n.s	n.s	n.s	<0.05
Gamma	-0.23	0.31	0.06	0.05	0.14	0.01

In contrast to the results for Moves, few age effects were evidenced. Only two of the F values reached significance: these were for Task Two and Task Six. Cell means for these two tasks reveal a non-linear trend once more, with seven year olds generating the smallest and nine year olds the largest number of strategies. Gamma values support the finding of significant age effects for Task Two indicating that older children are 31% more likely to generate more strategies than younger children. The gamma value for Task Six, however, shows a weaker relationship with only a 1% probability that older children will generate more strategies.

The general pattern, then, is one in which the number of strategies generated for each task is relatively stable with age but not their elaboration in terms of moves.

The non-linear trend for Moves can be attributed to the interaction of concurrent developments in metacognitive knowledge and economy of presentation. Seven year olds - being less cognitively mature and having less experience in learning and problem-solving - would be expected to generate a lower number of moves than children in the older age groups. Indeed, the majority of their strategies were single-move strategies. Nine year olds, in contrast - with an increased metacognitive knowledge - generate more elaborate, multi-move strategies. The reduction in number of moves generated by eleven year olds does not reflect less elaborate strategies but, rather, greater economy in their presentation. By this age, with continuing metacognitive knowledge and experience, some of the moves become redundant or are subsumed within more complex strategies. Concurrently, the language of presentation gains in sophistication and serves also to reduce the number of moves.

Task One which asks children to generate strategies for learning from prose provides a good case in point. For the seven year olds, the most common response on this task was *"read"*. It was typically presented as a one-move strategy. In contrast, the nine year olds embedded reading as a move within a strategy. Two common responses were

> *"I would read it over and over and put it in my mind"*
> (two moves: read, rehearse)
>
> *"I would read it, look away, see what I could remember, then read it again"*
> (three moves: read, rehearse, read/check)

Here reading, rather than being a strategy in its own right, is subsumed as a move in a more elaborate strategy. Responses of many eleven year olds were different again. Within this group two processes were observed. Firstly, *"reading"* was subsumed within the whole strategy. Many subjects appeared to view reading as a pre-condition for the problem of learning from prose and did not explicitly state it as a move. Thus, whilst one eleven year old suggested a strategy of "*scanning*" (one move), a nine year old capturing the same notion suggested "*read through quickly and pick out the important words and ideas*" (3 moves).

In summary, the pattern of development indicated by the results for Moves and Strategies can be explained by an increased metacognitive knowledge and concurrent development of sophistication in terms of both metacognitive concepts and language.

Age effects for Strategy evidenced in both Task Two and Task Six are anomalous; the result for Task Six is likely to be a statistical artefact. The gamma value does not support the ANOVA finding of an age effect indicating only a 1% probability that older children will generate more strategies than younger children. The age effect for Task Two, however, does appear to be a valid result. The Gamma values confirm the finding. This finding reflects a failure by older subjects to co-ordinate moves into more elaborate and sophisticated strategies on this task. Moves and Strategies in this case do not appear to be distinguished. Means for Moves and Strategies are very similar ($\bar{x}$ moves = 2.5, $\bar{x}$ strategies = 2.2) indicating that many strategies were single-move strategies. This being the case, it is not surprising that the trend found for the Moves variable is repeated. The failure of the older children to integrate moves here must be explained in terms of the task itself. The problem may not lend itself to more elaborate strategies or a floor effect may be evidenced. The former is the most likely explanation.

Highest score

The results of the analysis of variance of Highest Score for each of the six tasks by age are presented in Table (6).

TABLE (6): MEAN HIGHEST SCORE, F VALUES AND PROBABILITY OF F FOR THE ANALYSIS OF VARIANCE OF HIGHEST SCORE FOR GENERATING STRATEGY TASKS BY AGE AND ASSOCIATED GAMMA VALUE

	TASK					
AGE	1	2	3	4	5	6
7	2.29	3.65	3.85	1.87	2.60	1.89
9	2.58	4.33	4.35	1.98	3.27	2.42
11	2.56	4.58	4.28	2.02	4.06	2.58
F value (df 2,143)	1.524	18.429	5.604	4.059	12.168	9.530
p	n.s	<0.001	<0.01	<0.05	<0.001	<0.001
Gamma	0.15	0.62	0.32	0.84	0.47	0.47

Analyses of Variance reveal significant age effects for all but Task One. Gamma values provide strong support for these findings. The results indicate that the Highest Score attained increases with age. For Tasks Two, Four, Five and Six, this trend is linear whilst for Task Three the significance derives from the difference between the seven year olds and the other two age groups.

The failure to find an age effect in Task One was anomalous. Examination of the frequencies across the five values for this task reveals a clustering of responses at values 3 and 4. This indicates that a large number of children in all three age groups have achieved this level of sophistication. The fourth value appears to be a cut-off point. Only 12% of responses were at the fifth and highest value. Though these were given by nine and eleven year olds, they were not sufficient to bring about the predicted age effect.

5.3.2 ORGANISATION OF PROSE

Consistency

For this index, measures were not repeated; thus, consistency of response was not at issue. The relationship between the three variables - Sentence Organisation, Theme Recognition and Theme Selection (consistency of rank order) - was of concern, however. To this end a contingency coefficient was calculated. The results are recorded in Table (7).

TABLE (7): CONTINGENCY COEFFICIENTS AND ASSOCIATED PROBABILITY FOR ORGANISATION OF SENTENCE (OS), THEME RECOGNITION (THR) AND THEME SELECTION (THS)

Variables	C	P
OS x THR	0.55	<0.01
OS x THS	0.62	<0.01
THR x THS	0.47	<0.01

The results indicate a positive and significant relationship between all three variables.

Additionally, Contingency Coefficients were calculated for each age group separately to ensure that results were not inflated as an artefact of developmental difference. The results are reported in Table (8).

TABLE (8): CONTINGENCY COEFFICIENT AND ASSOCIATED PROBABILITY FOR ORGANISATION OF SENTENCE (OS), THEME RECOGNITION (THR) AND THEME SELECTION (THS)

Age Group	7		9		11	
	C	P	C	P	C	P
OS x THR	0.51	<0.01	0.63	<0.01	0.54	<0.01
OS x THS	0.49	<0.01	0.45	<0.01	0.48	<0.01
THR x THS	0.14	<0.05	0.42	<0.01	0.43	<0.01

The results confirm the strong relationship between Organisation of Sentence and both Theme Recognition and Sentence Selection for all three age groups. However, the relationship between Theme Selection and Theme Recognition proved to be less stable. A positive and significant relationship was found for nine and eleven year olds but for the seven year olds the relationship was considerably weaker. This result suggests that some seven year olds have a "*mediation deficiency*" (Flavell, 1978). Whilst those subjects in the nine and eleven years age groups who recognised the themes also used them to aid recall, those in the seven year age group recognising the themes were less likely to realise their value as aids for recall.

Development

Initially, frequencies of each of the variables for each of the age groups were separately examined. These are presented in Table (9).

TABLE (9): FREQUENCIES FOR ORGANISATION OF SENTENCE, THEME RECOGNITION AND THEME SELECTION BY AGE

Age Group	7	9	11
Organisation of Sentence			
"unorganised"	20	9	0
pairs	16	9	5
thematic 3s and 4s	9	12	14
complete 3 x 4	3	20	29
Theme selection			
selected	4	26	44
Theme Recognition			
recognised	14	34	44

A clear, linear age trend is evident in these frequencies. The results for Organisation of sentence indicate that the majority of seven year olds either "randomly" positioned the sentences or organised them in a pair-wise fashion whilst the majority of nine and eleven year olds used thematic organisation.

The results for Theme Recognition and Selection indicate that very few seven year olds either recognised or selected the themes embedded in the sentences. The majority of nine and eleven year olds, in contrast, both recognised and selected the themes. The correspondence between recognition of themes and their selection as cues for recall increased with age. The results for the eleven year olds indicate a perfect correspondence whilst a number of nine year olds, and the majority of seven year olds who recognised the themes, failed to select them as cues for recall.

To establish the statistical significance of these results a series of one-way analyses of variance for each variable by age was conducted. The results are presented in Table (10).

TABLE (10): MEAN SCORE, F VALUES AND PROBABILITIES FOR THE ANALYSES OF VARIANCE OF ORGANISATION OF SENTENCE, THEME RECOGNITION AND THEME SELECTION BY AGE

		Variable	
Age	Organisation	Recognition	Selection
7	1.90	0.29	0.08
9	2.98	0.72	0.45
11	3.50	0.92	0.71
F	38.953	29.914	26.269
df	3, 141	1, 141	1, 141
P	<0.001	<0.001	<0.001

The results indicate highly significant age effects for all three variables, with cell means reflecting the clear linear trend discussed above.

In summary, the results for the Organisation of Prose indicate an increasing use of thematic organisation with age and an increasing recognition that these themes can be used to facilitate later recall.

5.3.3 WORD LIST GENERATION

Consistency

To examine the consistency of response - namely the consistency of organisational principle employed across the six tasks - correlations of like variables (GRAPHIC, PHONIC, FUNCTION, DESCRIPTION, CATEGORY, CO-ORDINATED, SPECIFIC CO-ORDINATED) were calculated using contingency co-efficients. The results are detailed in Appendix 13. The results revealed a high degree of consistency for all variables. The ranges for C were:

GRAPHIC: 0.66 - 0.70; PHONIC: 0.67 - 0.70; FUNCTION: 0.32 - 0.65; DESCRIPTION: 0.16 - 0.41[3]; SPECIFICALLY CO-ORDINATED: 0.30 - 0.50; CO-ORDINATED: 0.20 - 0.40; CATEGORY: 0.40 - 0.55.

The high correlations across the six tasks suggest that children were, in fact, employing a consistent principle of organisation. Thus, children who gave a particular organisational response to one task were highly likely to give a similar response to other tasks. Children who gave no organisational response to one task were also highly likely to respond similarly to other tasks.

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[3] One anomalous result excluded.

In view of this finding of high across-task consistency in responses for the examination of developmental differences, like variables for each of the six tasks were aggregated to create new variables based on total scores.

The new variables were designated by the suffix TOT where distinction between these and the individual task variable were necessary (namely for computing). Thus, GRAPHIC became GRAPHTOT, for example. The following discussion, however, pertains to total score variables only and the TOT prefix is not employed.

Development

Two developmental questions were of interest:

1. Type of principle used: Did children in the three age groups utilise different principles of organisation?
2. Cohesion of responses: Did children in the three age groups differ in the degree to which they co- ordinated the word lists generated?

An examination of the first five variables - (GRAPHIC, PHONIC, FUNCTION, DESCRIPTION, CATEGORY), called collectively Individual Functions - pertains to the former of these issues whilst examination of Co-ordination and Specific Co-ordination variables pertains to the latter.

To establish whether there were any significant age effects a series of one-way analyses of variance for each of organisational principle variables by age was conducted.

Individual Functions:

The results of the analyses of variance are presented in Table (11).

TABLE (11): MEAN NUMBER OF ORGANISATIONAL RESPONSES, F VALUES AND PROBABILITY OF F FOR THE ANALYSES OF VARIANCE OF INDIVIDUAL ORGANISATIONAL PRINCIPLE BY AGE

Age	Organisational Principle				
	Graphic	Phonic	Function	Description	Category
7	0.98	0.67	0.40	1.96	3.62
9	0.73	0.67	0.56	1.73	4.48
11	0.19	0.19	0.23	2.10	5.27
F (df 2,141)	3.262	1.795	2.695	0.687	10.696
P	<0.05	n.s	n.s	n.s	p<0.001

Significant age effects emerged for the Graphic variable. Examination of the cell means indicates a declining use of graphic principles of organisation with age. This decline is particularly marked between the ages of nine and eleven.

Surprisingly, no age effects emerged for the Phonic variable though again a marked decrease in the use of this principle is evidenced by eleven year olds. This is contrary to the findings of Tenney (1976). Differences here may reflect changes in the coding systems of the two studies. In the present study, Tenney's Phonic category was tightened to refer to rhyme rather than "*sound clang*" whilst the Graphic category was introduced to distinguish between the use of sound and visual bases of classification. Results here suggest a greater use of visual attributes rather than those of sound in the organisation of word lists.

Age effects emerged for Category. Cell means indicate a linear trend with an increased use of a principle of category with age in the organisation of word lists.

Co-ordinated functions:

The results of the analyses of variance are presented in Table (12).

TABLE (12): MEAN ORGANISATIONAL RESPONSE, F VALUES AND PROBABILITY OF F FOR CO-ORDINATED AND SPECIFICALLY CO-ORDINATED PRINCIPLES BY AGE

Age	Organisational Principle	
	Co-ordinated	Specifically Co-ordinated
7	2.81	0.71
9	3.73	1.37
11	3.78	2.08
F (df 2,141)	4.970	11.815
P	<0.01	<0.001

Significant age effects emerged for both Co-ordinated and Specifically Co-ordinated variables. Cell means indicate that there is a greater cohesion in responses with age. Older children, it would seem, relate words generated not only to the cue word but also to each other, increasing the probability of recall.

5.3.4 JUDGING TASK DIFFICULTY

Consistency

Selection

To establish the consistency of Selection response within task sets (set one - number; set two - relatedness; set three - meaningfulness), correlations were calculated for each age group separately using contingency coefficients. The contingency coefficient method was employed here as data were dichotomous. The results are presented in full in Appendix 14. Means and ranges are presented in Table (13) below.

TABLE (13): MEANS AND RANGES OF CONTINGENCY COEFFICIENTS FOR WITHIN TASK JUDGING TASK DIFFICULTY ITEMS, BY AGE

	Age					
	7		9		11	
Set	Mean	Range	Mean	Range	Mean	Range
1	0.66	0.62-0.69	0.68	0.66-0.71	0.67	0.66-0.71
2	0.49	0.35-0.62	0.52	0.35-0.68	0.61	0.48-0.62
3	0.70	0.69-0.71	0.685	0.68-0.69	0.67	0.64-0.69

These results reveal a high within-set consistency for all age groups.

Rationale

To establish the consistency of rationale response within item sets, Pearson's correlation coefficients were calculated - for the total sample firstly and then for each age group separately. The results are presented in Appendix 15 and summarised as a count of significant correlations in Table (14).

TABLE (14): COUNT OF SIGNIFICANT WITHIN SET CORRELATIONS OF RATIONALE OF JUDGING TASK DIFFICULTY ITEMS FOR THE TOTAL SAMPLE AND FOR EACH AGE GROUP SEPARATELY

Task Set	All	7	9	11
1	6	5	4	*
2	3	3	3	3
3	3	3	3	3
No. Significant	12	11	11	*
Total	12	12	12	12

* correlation coefficients could not be calculated

The results for the total sample reveal positive and significant correlations for all three task sets. This suggests that responses were consistent within the task sets. Results of the correlations by age group indicate this consistency was maintained in the separate analyses. Correlations were positive and significant for all Set Two and Set Three items across all age groups. Matrices of the seven and nine year olds for Set One indicated that, in all but one case, significance was maintained. For the eleven year olds the correlation coefficient could not be calculated because of lack of variance. In this group the large majority of children responded in the same way providing a "standard rationale".

Development

Selection

To establish whether there were any significant age differences in selection for each task a one-way analysis of variance by age was conducted. The results are reported in Table (15).

TABLE (15): MEAN NUMBER OF CORRECT SELECTIONS, F VALUES AND PROBABILITY FOR ANALYSES OF VARIANCE OF SELECTION OF JUDGING TASK DIFFICULTY ITEMS BY AGE

Age	Items									
	Set One				Set Two			Set Three		
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3
7	0.83	0.81	0.71	0.85	0.73	0.62	0.42	0.25	0.27	0.49
9	0.81	0.87	0.85	0.81	0.79	0.83	0.48	0.25	0.31	0.27
11	0.81	0.87	0.87	0.81	0.83	0.94	0.67	0.48	0.44	0.37
F	0.46	0.49	2.64	0.20	0.77	8.27	3.34	3.95	1.61	0.94
df (2,141)										
p	n.s	n.s	n.s	n.s	n.s	<.001	<.05	<.05	n.s	n.s

The results indicate only three significant age effects across the ten items. These were for items 2.2, 2.3 and 3.1. Cell means indicate that for both the Set Two items correct choice increased with age. For the Set Three item, seven and nine year olds have equal means, whilst significantly more eleven year olds made the correct choice for this item.

The non-significant results for all items in Set One is expected. The result indicates that all age groups understand the notion that a greater number of items increases difficulty of recall, other things being equal. Significant age effects were expected, however, for the other two task sets. The failure of this to occur in all instances is most likely attributable to the correct choice of items on the basis of an "inappropriate rationale". Thus, for example, the selection score for seven year olds in item 2.1 is likely to be inflated by the fact that many children "*liked the words better*" on the correct choice than on the incorrect choice (42% of the sample).

Rationale

To investigate the developmental differences in Rationale given for Judging Task Difficulty items a series of one-way analyses of variance of rationale for each item by age was conducted. The results are reported in Tables (16), (17) and (18).

TABLE (16): MEAN RATIONALE SCORE, F VALUES AND PROBABILITY OF F FOR ANALYSES OF VARIANCE OF RATIONALE FOR JUDGING TASK DIFFICULTY ITEMS: SET ONE BY AGE

	Item			
Age	1.1	1.2	1.3	1.4
7	2.60	2.50	2.27	2.48
9	2.71	2.67	2.52	2.60
11	2.83	2.79	2.75	2.77
F	1.54	1.53	3.52	1.77
df (2, 141)				
P	n.s	n.s	<.05	n.s

TABLE (17): MEAN RATIONALE SCORE, F VALUES AND PROBABILITY OF F FOR ANALYSES OF VARIANCE OF RATIONALE FOR JUDGING TASK DIFFICULTY ITEMS: SET TWO BY AGE

	Item		
Age	2.1	2.2	2.3
7	1.33	1.48	1.31
9	1.87	2.02	1.98
11	2.67	2.71	2.50
F	23.67	20.57	21.94
df (2, 141)			
P	<0.001	<0.001	<0.001

TABLE (18): MEAN RATIONALE SCORE, F VALUES AND PROBABILITY OF F FOR THE ANALYSES OF VARIANCE OF RATIONALE FOR JUDGING TASK DIFFICULTY ITEMS: SET THREE, BY AGE

	Item		
Age	3.1	3.2	3.3
7	1.35	1.29	1.48
9	1.40	1.50	1.56
11	1.94	1.85	1.81
F	7.52	5.17	1.83
df (2, 141)			
P	<0.001	<0.01	n.s

The results indicate that for Task Set One significant age effects emerged for only one of the four items. The non-significance of the remaining three items suggests that, in general, children in all three age groups were able to provide an appropriate rationale: namely, that the greater the number of items the more difficult the list to learn and remember, other things being equal. Cell means for the significant item indicate a linear trend with the use of an appropriate rationale increasing with age. The explanation for this result is not clear. One possibility is that subjects were employing a principle of "inclusiveness". The word list for 1.3 listed farm animals. It may be that subjects felt a more inclusive list of such words would be "*easier to learn and remember*". Examination of raw data does indeed suggest that a principle of inclusiveness is employed by some subjects. However, such responses are more characteristic of older subjects. This explanation would thus run contrary to the direction of the cell means. In fact, raw data suggest younger children are selecting longer lists because they "*can read all the words*" or "*know all the words*". It seems they are confounding ability with task difficulty. Significant age effects emerged on all Set Two items. In all cases, the cell means indicate a trend linear with age, with an increase in the provision of valid rationales. A significant age trend emerged for two of the three items in Set Three. Again, cell means indicate a trend linear with age, with an increasing provision of appropriate rationales. The failure of item 3.3 to reach significance was unexpected and the explanation of this is likely to be found in the quality of the item itself.

In summary, the results for Judging Task Difficulty present a picture of consistent selection and rationale responses within each task set. Children did not respond randomly to the ten items but identified the three task types and responded to each of them in the same way. Children in all three age groups indicated through their rationale responses an understanding of the principle of number (Set One): that a smaller number of items is easier to recall than a larger set, other things being equal. One item in Set One did present difficulty for the seven year olds, however. Age effects emerged for the items of Sets Two and Three indicating developmental differences in the understanding of the principles of "Relatedness" and "Meaningfulness". Understanding of both these principles increased with age.

5.4 THE MAIN STUDY: STUDY 1B - SELECTION OF VARIABLES AS METACOGNITIVE INDICES

The original number of variables generated from the four metacognitive measures was fifty three: eighteen from Generating Strategies, twenty from Judging Task Difficulty, twelve from Word List Generation and three from Organisation of Prose. From these, eight variables were to be selected to serve as metacognitive indices. Selection entailed a two-stage reduction. In the first stage a within-measure reduction was conducted whilst, in the second, factor analysis procedures were used to assess the relationship between measures and finally to select representative variables as indices of metacognition. The two stages are detailed below.

5.4.1 Stage One: Within-measure Reduction

In the first stage of reduction, variables within each of the measures were examined. Reduction was guided by both theoretical and statistical criteria. The aim was to select a smaller number of variables within each measure which were distinct in terms of the aspects of metacognition they measured and their statistical relationship. Three procedures for reduction and selection were employed to this end:

1. exclusion of variables lacking clarity
2. reduction of repeated measures by aggregation
3. selection of representative variables from related variable groupings

Exclusion of variables lacking clarity

In this initial stage, variables for which there was ambiguity of measurement, scoring or results were excluded. Fifteen variables were omitted in this way. Three variables were drawn from Task Four in the interview measure, Generating Strategies. The scoring system for this question had presented a number of difficulties and subsequent results revealed a very small variance both within and between age groups. Thus, all three variables pertaining to this task were excluded from further analysis. Similarly, two variables drawn from Word List Generation were omitted. The two organisational principles of Function and Description had proved to be ambiguous. These two variables had been drawn from the original study of Tenney (1976) who had used only nouns as cue words for the word generation task. In the present study, different parts of speech were used as cue words and the role of the organisational principles of Function and Description became less clear. The results on these two variables yielded low means and non-significant age differences. It was thus decided that these variables could be excluded at this stage. Finally, ten variables pertaining to Judging Task Difficulty were omitted. These were all the Selection variables which indicated the choice made on each of the ten tasks presented. It was decided to exclude these variables both because of the high chance element they carried (0.5 correct response by chance) and because they were in many ways superseded by the remaining ten variables which related to the rationale for selection.

All remaining variables within each measure were judged to be satisfactory at the level of clarity. The statistical relationship of these variables guided further reduction and selection.

Reduction of Repeated Measures by Aggregation

For both Judging Task Difficulty and Word List Generation measures had been repeated. Judging Task Difficulty presented three sets of repeated measures (Set 1 - four items; set 2 - three items; Set 3 - three items) whilst Word List Generation presented six repeated measure tasks. At this stage of the reduction the correlations of each variable across the repeated measures were examined with a view to aggregating scores if they were significantly correlated. This was, in fact, the case. Correlations indicated positive and significant relationships between like variables across all repeated measures in both Judging Task Difficulty and Word List Generation. Like variables across the repeated measures were thus aggregated to create one summated score variable. For Judging Task Difficulty this meant that three variables were created from the ten original: one variable representing the aggregate of each task set. For Word List Generation five variables were created, each representing a different principle of organisation used over the six repeated measures (Graphic Total, Phonic Total, Category Total, Co-ordinated Total and Specifically Co-ordinated Total). The number of variables was further reduced by collapsing two categories - Graphic and Phonic Totals - thus re-establishing the coding of the original study by Tenney (1976). Essentially this created a "non-semantic" organisation category.

In summary, seven new variables were created by aggregating significantly correlated variables on repeated measures:

Judging Task Difficulty

RAT1 - rationale for selection in Set One: number

RAT2 - rationale for selection in Set Two: relatedness

RAT3 - rationale for selection in Set Three: meaningfulness

Word List Generation

GPTOT -	total of organisation by non semantic features: graphic and phonic
CATTOT -	total organisation by category
CORDTOT -	total co-ordinated organisation
SPCTOT -	total specific and co-ordinated organisation

3. *Selection of Representative Variables*

Within-measure correlations drawn from Generating Strategies and Organisation of Prose were examined. The aim was to identify 'groupings' of related variables and then select a smaller number of variables to represent these groupings. For

Generating Strategies there were fifteen variables after the exclusion of those pertaining to task four (five tasks x three variables - Moves, Strategies, Highest Score). Correlations within each of the tasks for the whole sample were significant in each case. Correlations for each age group separately, however, indicated that for nine and eleven year olds whilst Moves and Strategies were significantly correlated, Highest Score was not. Thus whilst Moves and Strategies formed a 'grouping', Highest Score was distinct. It was decided on this basis that the Highest Score variable for each of the five questions should be retained but that variables should be selected to represent the quantitative variable grouping formed by Moves and Strategies. To this end, an examination of across-task correlations of Moves and Strategy separately was made. Consistent and significant correlations were obtained for the Moves variable across the six tasks. Strategy was less consistently correlated. It was thus decided to select the Moves variable for each of the six tasks to represent the quantitative group of variables.

For Organisation of Prose, the original variables numbered only three. Correlations between these three variables across the whole sample revealed that all three were significantly related. Correlations by age indicated that Theme Recognition and Theme Selection were both significantly correlated with Organisation by Theme but not with each other. These results clearly pointed to the selection of Organisation by Theme as the variable to represent the grouping of related variables. Organisation was selected but the variable Theme Selection was also retained on theoretical grounds. It was felt that whilst this variable correlated significantly with organisation by Theme, it was distinct in theoretical terms.

Nineteen variables thus remained for the second stage of reduction. These are summarised in Table (19) below:

TABLE (19): REMAINING METACOGNITIVE VARIABLES AFTER STAGE ONE REDUCTION

Variable	Description	Measure
GSAM	Task 1 Moves	Generating Strategies
GSAHS	Task 1 Highest Score	
GSBM	Task 2 Moves	
GSBHS	Task 2 Highest score	
GSCM	Task 3 Moves	
GSCHS	Task 3 Highest score	
GSEM	Task 5 Moves	
GSEHS	Task 5 Highest Score	
GSFM	Task 6 Moves	
GSFHS	Task 6 Highest Score	
OS	Organisation by Theme	Organisation of Prose
THS	Selection of Theme	
GPTOT	Graphic and Phonic	Word List Generation
CATTOT	Category	
CORDTOT	Coordinated	
SPCTOT	Specific coordinated	
RAT1	Rationale for set 1	Judging Task Difficulty
RAT2	Rationale for set 2	
RAT3	Rationale for set 3	

5.4.2 STAGE TWO: ACROSS MEASURE REDUCTION BY FACTOR ANALYSIS

In the second stage of reduction, an examination of the statistical relationship of the remaining nineteen variables was made. Factor analytic procedures were used to establish, in a more objective way, the relationship between these variables. Four factor matrices were generated: one for the whole sample and one for each age group separately. By analysing both by whole sample and by age group, it was hoped that the disadvantages of each could be offset. Whilst the whole sample analysis was likely to be subject to developmental distortions, the smaller sample size of the age group analysis rendered the results less reliable. In analysis both by age and for the whole sample a Principal Axis Factoring (PAF) method of extraction was employed. This method was used because it accounts only for shared variance across variables (Comrey, 1973). The concern here was not with unique variance of individual variables. Subsequent matrices were rotated using a varimax rotation procedure. The criterion for the number of factors to be extracted was Kaiser's Criterion (an eigenvalue equal to or greater than 1.0, though note was taken of those factors approaching this level in the comparison of the four matrices). The purpose of the Factor Analysis was to identify the two variables which most clearly defined each factor and not to interpret all factors. One method to determine the significance of a loading is the Burt-Banks formula (Child, 1970). Here the size of the loading required for significance decreases with the sample size and with the number of factors extracted. Since each factor matrix was based on nineteen variables, but sample size varied, the loading was fixed at 0.38 (that necessary for a matrix of order 50 x 20). This was particularly stringent when applied to the larger samples and thus limited factor definition, but did not affect the selection of variables which was guided by a criterion of highest factor loadings. The results of the analyses are summarised in Tables (20) to (23) and are presented in Appendix 16.

TABLE (20): SIGNIFICANT FACTORS (EIGEN VALUE > 1) AFTER PRINCIPAL AXIS FACTORING OF METACOGNITIVE VARIABLES AND VARIMAX ROTATION, TOTAL SAMPLE (N=144)

Factor 1		Factor 2		Factor 3		Factor 4	
GPTOT	-.71	GSEHS	.50	GSAM	.46	THS	.72
CATTOT	.90	GSFHS	.45	GSBM	.38	OS	.76
CORDTOT	.88	RAT2	.63	GSCM	.69		
SPCTOT	.64	RAT3	.60	GSEM	.46		
				GSFM	.50		

TABLE (21): SIGNIFICANT FACTORS (EIGEN VALUE > 1) AFTER PRINCIPAL AXIS FACTORING OF METACOGNITIVE VARIABLES AND VARIMAX ROTATION, 7 YEARS (N=48)

Factor 1		Factor 2		Factor 3		Factor 4		Factor 5	
GPTOT	-.68	GSCHS	.44	THS	.52	GSAM	.76	OS	.66
CATTOT	.90	GSEM	.48	OS	.95	GSAHS	.81	THS	.73
CORDTOT	.92	GSEHS	.68						
SPCTOT	.62	RAT2	.46						
		RAT3	.41						

TABLE (22): SIGNIFICANT FACTORS (EIGEN VALUE > 1) AFTER PRINCIPAL AXIS FACTORING OF METACOGNITIVE VARIABLES AND VARIMAX ROTATION, 9 YEARS (N=48)

Factor 1		Factor 2		Factor 3		Factor 4	
GPTOT	-.78	GSAM	.62	THS	.52	GSEHS	.68
CATTOT	.92	GSAHS	.56	OS	.95	RAT2	.66
CORDTOT	.88	GSBM	.50			SPCTOT	.39
SPCTOT	.68	GSCM	.63				
		GSCHS	.43				
		GSEM	.59				

TABLE (23): SIGNIFICANT FACTORS (EIGEN VALUE > 1) AFTER PRINCIPAL AXIS FACTORING OF METACOGNITIVE VARIABLES AND VARIMAX ROTATION, 11 YEARS (N=48)

Factor 1		Factor 2		Factor 3		Factor 4		Factor 5*	
GSBM	.41	CATTOT	.38	GSAHS	.84	GPTOT	.73	THS	.68
GSBHS	.71	SPCTOT	.66	GSFM	.50	CATTOT	-.75	OS	.90
GSEM	.38	CORDTOT	.93	RAT2	.42	GSFM	.49		
GSEHS	.71			RAT3	.41				
RAT3	.47								

* Eigen value =.98

Whole Sample Analysis

Three factors with eigen values greater than one emerged from the factor analysis of the whole sample.

Factor One relates directly to the Word List Generation measure and represents Organisation by semantic features. The negative loading on the Graphic and Phonic variable - a non-semantic organisational variable - would be expected in this case. It should be noted that this is not a statistical artefact of the scoring. These categories were not exclusive.

Factor Two combines qualitative variables from two measures, Judging Task Difficulty and Generating Strategies. All variables contain a problem-solving and reasoning element.

Factor Three appears to be a quantitative measure: a measure of productivity on Generating Strategies. It represents the number of moves generated in solution of all five included tasks in Generating Strategies.

The fourth factor presented here does not reach the criterion of an eigen value greater than one but is included here for the sake of comparison with factor analyses by age where the two variables which comprise this factor again emerge. The two variables - Organisation by Theme and Selection of Theme - are both drawn from the Organisation of Prose measure and represent organisation for recall.

Analysis by Age

The results of Factor analyses by age, whilst different, do resemble results of the whole sample analysis. In all three analyses, Factor One from the whole sample matrix again emerges (seven years - factor 1; nine years - factor 2; eleven years - factor 2). Factor two from the whole sample emerges, to varying degrees, in the analysis by age. Rationale variables from Judging Task Difficulty and variables from generating strategies come together as a factor for both seven and eleven year olds. For nine year olds the factor comprises Generating strategies variables only. Factor Three - the productivity measure - is least consistent across the analysis by age. Such a distinct factor does not emerge in any of the analyses by age. Rather, groupings of both qualitative and quantitative variables from the Generating Strategies measure come together as a factor. Factor Four, from the whole sample did not reach the Kaiser criterion of an eigen value equal to or greater than one. It does, however, emerge in two analyses by age and just fails to reach Kaiser's criterion on the third.

On the basis of the four factor matrices, four factors were derived:

1. Organisation by semantic feature
2. Problem solving
3. Productivity
4. Organisation for recall

Selection was made from the variables that comprised each factor of representative variables which would act as metacognitive indices. Selection was made on the basis of factor loadings. Those variables which carried the highest factor loadings for each factor were assumed to be the most characteristic of the factor. On this basis the two variables with the highest factor loadings for each factor were selected to represent that factor. The final selection was as follows:

Factor 1: Organisation by semantic features

CATTOT

SPCTOT

Factor 2: Problem solving and reasoning

RAT2

GSEHS

Factor 3: Productivity

GSAM

GSCM

Factor 4: Organisation for recall

THS

OS

CHAPTER 6

STUDY TWO: METACOGNITION AND ATTRIBUTION FOR LEARNING OUTCOME

In the second stage of the study, subjects completed a learning task and subsequently made attributions for their performance. This was conducted within a 2 x 2 design with two conditions for learning (Verbatim processing versus Meaningful processing) and two conditions of definition of learning outcome (Experimenter-defined versus Self-defined). Metacognitive performance, assessed by the metacognitive indices derived in study one, served here as an independent variable.

6.1 PRELIMINARY INVESTIGATION AND PILOT STUDIES

Pilot studies were conducted in the process of choosing and preparing learning tasks, post-tests, mode of defining learning outcome and mode of acquiring attribution responses.

6.1.1 SELECTION OF LEARNING TASK

In the selection of an appropriate learning task for the experimental stage of the study, a number of restrictions were imposed both by the age and range of the sample and by the experimental requirements. Firstly, the task had to be appropriate for all children across the age range of the study (6.5 - 11.5 years). Secondly, there was a preference for a task which was school-related so that results would, as far as possible, possess ecological validity. Finally, to examine the hypothesis that different levels of processing of the learning task will produce different attributions, the task needed to be manipulable in terms of the level of processing. This proved to be the most difficult requirement to fulfil. Two approaches to the problem were considered:

1. selection of different tasks which were judged to require different levels of involvement;
2. selection of one task with provision of different task orientation to achieve different levels of processing.

It was decided that the latter was the preferable approach. Whilst it was reliant on the success of orientating instructions, it did not present the difficulty of ascertaining levels of equivalence or otherwise. It was decided that a reading comprehension task would best fit the outlined criteria. However, as children of the sample age range are still *"learning to read"* and are therefore at different levels of competency, the selection of reading material appropriate to age was necessitated. Thus, three prose passages and respective post-tests were required - one for each age group.

With the assistance of teachers and library staff, three age-graded factual prose pieces - all of which detailed information about animals - were selected as potential source materials for the experimental task. These were pilot tested for suitability.

6.1.2 Pilot Study Four: Reading Materials

Subjects

Nine pupils attending a Bristol Primary school participated in the study, three children from each of three class groups: top infants, second year juniors and fourth year juniors. From each class, a teacher-defined "poor", "average" and "good" reader was represented.

Procedure

Subjects were withdrawn individually from their class to a library room where they were asked to read the age-appropriate prose passage to the experimenter. Although in the main study it was not planned to have the children read aloud, it was a necessary procedure at this stage. The ease of reading and time taken to complete the passage were recorded. The child's reaction in terms of enjoyment and interest were also recorded.

Results

For those subjects defined as average or good readers the reading materials were satisfactory. These subjects read the text with few errors or difficulties. However, poor readers in all three age groups found the materials difficult to read and had to ask for experimenter assistance.

It was thus decided that the reading materials were satisfactory for average and above average readers and that the sample for the main study should be restricted to such children. It was felt that, for those children who found the passage difficult to read, attributions may be affected by the anxiety it created. Moreover, attributions would probably be made for reading rather than for learning for these subjects. The general response to the passages was favourable. The content appeared to be of interest to the children and appropriate for age.

6.1.3 Test Materials and Orientating Procedure

Having selected reading materials, related comprehension tasks were written. For each of the three prose passages, two post tests were written. These two post-tests corresponded to two task orientations:

Test 1: Verbatim recall orientation: required subjects to identify whether sentences presented had actually appeared in the passage.

Test 2: Meaning orientation: required subjects to indicate factual accuracy of presented sentences based on reading of the passage.

Each contained the same number of items and required the same response format but varied in degree of meaningfulness. Additionally, a set of illustrative materials was written for use in demonstrating the two orientations.
The test materials and illustrative set were pilot tested to assess substantive content and ease of administration.

6.1.4 PILOT STUDY FIVE: ASSESSMENT OF TEST MATERIALS AND ILLUSTRATIVE ITEMS.

Subjects
Twelve children drawn from an urban Bristol primary school participated in the the study: four children from each of the three designated class groups.

Procedure
Subjects were withdrawn from class and worked on an individual basis with the experimenter. Two children from each age group were presented verbatim orientation and two meaningful orientation. The children were shown the test they were to complete prior to reading the prose passage. The test was explained to them. The illustrative item was then presented and the child asked to complete a response relating to the illustrative item. The child then read the age-appropriate prose passage and given as much time as he required. He then completed a post-test

appropriate to his task orientation. Note was taken of reading time, administrative difficulties, response time and substantive responses.

Results

In terms of general administration the illustrative item, reading and post-tests were all satisfactory. It was noted, however, that some children were anxious about response format on commencement of the test. It was thus decided, in order to alleviate this problem and as a check procedure, to insert two warm-up items at the commencement of the test.

Reading time varied considerably within the age groups, with some children reporting reading the passage a number of times. This was to be allowed within the experimental procedure. Its occurrence, however, reinforced the value of recording the reading time. The administration of orientation, illustrative task, reading and post-test took approximately 15 minutes.

Examination of responses on each of the six tests indicated that a range of scores were attained and thus all were deemed satisfactory.

6.1.5 Outcome Definition

Following completion of the learning task (reading and post test), the children were either to receive an outcome definition from the experimenter or were themselves to define the outcome. It was decided that the experimenter definition would be based on a group norm. Children would be defined as "success", "average" or "failure" relative to this norm. A pilot study was conducted to establish the norm.

6.1.6 Pilot Study Six: Establishing a Norm for Outcome Definition.

Subjects

Thirty students attending a Dorset primary school participated in the study: ten children from each of the designated class groups.

Procedure

Each test was completed by five subjects. The tests were administered by class teachers. Mean scores were calculated for each test.

Results

Means for each test are presented in Table (24).

TABLE (24): MEAN SCORES ON POST TESTS FOR PILOT STUDY SIX

	Orientation		
Age	Verbatim	Meaning	Total
7	5.5	7.25	6.3
9	6.5	6.8	6.6
11	7.2	7.3	7.3

Standardised experimenter definitions were devised on the basis of these. An open-ended question and probes were devised to attain outcome definition for those in the self-defined condition. Both these formats were assessed in Pilot Study Seven which also examined the attribution response format.

6.1.7 ATTRIBUTION RESPONSE FORMAT

Following Weiner's work in the application of attribution theory to achievement motivation in the classroom (Weiner, 1983), the standard method for attaining attribution for learning outcome has been a format in which subjects choose between one of four attributes: Task, Ability, Luck or Effort. In the present study, a departure was made from this convention.

Recent research has suggested that the techniques adopted by Weiner are too restrictive (Stratton et al., 1986) particularly where respondents are children (Little, 1985; Frieze, Francis and Hanusa, 1983; Elig and Frieze, 1979). Attribution research in Clinical Psychology, which reports post hoc methods of examining interview data, provides an alternative framework. It points to the feasibility of collecting open-ended accounts of an event which might be later categorised. Such approaches have been effectively used in education (for example: Cooper and Berger, 1980; Cauley and Murray, 1982).
It was decided to adopt such an approach in attaining attributions in the present study. Two open-ended attribution questions were devised. These were to be presented orally and recorded on audio tape. It was felt that this technique was preferable as there were less external demands than those posed by a written format.

To assess attribution response format and to further assess the outcome definition format, a pilot study was conducted.

6.1.8 Pilot Study Seven: Assessment of Attribution and Outcome Definition Format

Subjects

Twenty three children drawn from an urban Bristol Primary school participated in the study: ten top juniors, eight second year juniors and five top infants.

Procedure

Each child worked individually with the Experimenter in a single session of approximately 20 minutes duration. Children were told they would be asked to read the prose passage and answer a test. They were shown the orientating test. The illustrative set was then introduced and the test format explained. The child then completed an illustrative item and was given feedback. The child was then asked if he understood the task. If the child was unsure, the illustrative item was repeated.. When the child indicated that the task was understood, the prose passage was presented. No restriction was placed on reading time or mode of reading (silent versus aloud). Reading time was recorded. When the child indicated reading was completed two orientation-appropriate "warm-up" test items were presented and responses checked by the experimenter before presentation of the post-test. On completion of the test outcome definition was provided (Experimenter-defined condition) or sought (Self-defined condition). Attribution responses were then sought. Children were debriefed at the end of the session.

Results

The general administration of the tasks, outcome definition and attribution formats was satisfactory. The need for one adjustment was noted, however. The original wording for both outcome definition and attribution questions used the word 'poor' to define a failure. In their own usage, however, the children appeared to favour and better understand the word 'bad'. It was thus decided to change the wording accordingly.

6.2 THE MAIN STUDY: STUDY TWO - EXPERIMENTAL

6.2.1 SUBJECTS

All subjects from Study One participated in this second study.

6.2.2 MATERIALS

Prose Passages

Three prose passages were the source material for the learning task. The passages were about kangaroos, penguins and pandas and were age-graded as appropriate for seven, nine and eleven year olds respectively. Each was presented on a single A4 sheet, had a three paragraph structure and a illustration at the bottom. These are presented in Appendix 17.

Post-tests

For each of the three passages there were two corresponding format matched post-test types. One presented a verbatim orientation and the other a meaning orientation:

Verbatim orientation - two practice items and ten test items were presented. In each, the item was a sentence to which the subject was to respond by indicating if the sentence appeared in that form in the passage. Response mode was a simple "tick the box" procedure.

Meaning Orientation - again two practice questions and ten test items were presented. In each case, a sentence was presented to which the subject was asked to respond by indicating factual accuracy based on the information given in the passage. Again the response mode was a simple "tick the box" procedure. Post tests are presented in Appendix 18.

Illustrative Set

The illustrative set comprised a single sentence - the content of which did not relate to any of the learning task passages - and corresponding verbatim and meaning orientation tests, each with two items. The format of each test was identical to that of the post-tests, however.

The illustrative set is presented in Appendix 19.

Response Formats

Standardised schedules for defining and acquiring learning outcome and for attaining attribution responses were prepared.

The standardised schedule for the definition of learning outcome is presented in Appendix 20 and that for attaining attribution responses in Appendix 21.

6.2.3 PROCEDURE

Each subject was assigned to one of four cells based on two conditions of learning outcome definition (Experimenter-defined vs Self-defined) and the two conditions of task involvement (Verbatim vs Meaning orientation). Each subject worked individually with the experimenter. At the beginning of the session subjects were told they would be asked to read the passage about pandas / penguins / kangaroos and then answer some questions about it. The children were then shown the post-test and given orientating instructions. Subjects in the Verbatim orientation condition

were finally instructed that *"to do well on the questions you will have to concentrate on exactly what each sentence is like"* whilst those in the meaning orientation condition were instructed *"to do well on the questions you will need to concentrate on the information in the sentences - what it tells you"*.
Subjects were then shown the illustrative set and completed the two items. In all cases subjects completed them correctly. The experimenter reinforced that this was correct by stating:

1) in the verbatim condition: *"that's right you concentrated on exactly what the sentence was like"*.
2) in the meaning condition: *"that's right you concentrated on what it told you"*.

Subjects were then presented with the age-appropriate passage and asked to read it. They were told they could take as long as they liked to read it, that they could read it silently or aloud and that they were free to read it as many times as they wanted. Finally the orientating instruction was repeated before reading commenced. All nine and eleven year olds chose to read silently. Approximately half the seven year olds read silently also. Reading times were recorded.

On completion of the reading, the subjects indicated readiness to complete the post-test. The two practice questions were presented and checked for procedural accuracy before presentation of the ten test items. The post-tests were then marked in the presence of the subject and a score out of ten given. Subjects in the Experimenter-defined outcome condition were then defined as Success, Failure or Average using the normative reference determined in Pilot Test Six. Those in the self-defined condition were asked to define the learning outcome using the standardised open-ended question and probes. These are presented in Appendix 21. Responses were tape recorded. Finally, attribution responses for all subjects were acquired using the open-ended attribution schedule. Responses were again tape recorded.

At the end of the session subjects were debriefed. For those subjects who had attained a Failure outcome, reattribution to task difficulty was made. Subjects were told that the tasks they had undertaken were very difficult. Frankel and Snyder (1983) report that such attribution reduces the effect that may result from a Failure outcome. Diener and Dweck (1978) report this as a suitable procedure. All subjects were thanked for their participation.

6.2.4 SCORING: ATTRIBUTION

Attribution scores were derived from the oral responses to two open-ended questions. Tape recorded responses were transcribed verbatim. From these transcripts, attributional statements were identified using the procedure outlined in the Leeds Attribution Coding System (Stratton et.al., 1986) where attributional statements were defined as

> *one that provides an explanation of the relationship between events, outcomes and/or behaviours and their causes.*

(page 20)

Attributional statements thus took the form of both reasons for and causes of events.

Attributional statements were then classified. Classification of responses departed from the established four category (Task, Luck, Ability, Effort) classification developed by Weiner (1978) because it was felt that this approach was too restrictive. A number of recent studies have pointed to the limitations of Weiner's approach (Little, 1985; Frieze, Francis and Hanusa, 1983; Thorpe, 1985) particularly in attributional studies of child populations. Little (1985), for example, argues that Weiner's classification is based on the model of an adult and is inappropriate for classification of attribution responses made by children whose subjective and objective reality differ from that of an adult. Little has proposed an eighteen category classification based on data from a British school population presented with six "simple stories representing a range of achievements and events".

Little's coding system was pilot-tested for appropriateness of use with the present data. As a recently derived system which was based on an age- and culture-appropriate population it appeared promising. It did not prove satisfactory, however. Whilst the approach was promising, many of Little's categories were not appropriate. They did not account for all the data in the present study. Differences in the data collection method between Little's study and the present study explain this discrepancy. Little's classification was based on data generated from hypothetical "stories" in which the child was an observer whilst, in the present study, a more naturalistic approach was employed with children making attributions for learning outcomes in which they had been the actor. Brown (1986) provides evidence that the hypothetical and real situation will elicit different attributions suggesting that the roles of the actor or observer provide a different psychological base from which events are viewed and explained. Jones and Nisbett (1972) and Buss (1978) similarly address this issue, proposing that the role assumed (actor versus observer) will effect attributions made because the roles provide different informational and motivational stances. An observer can provide only cause - a generalised law; whilst the actor can provide both cause and reason - specific, subjective attributions. It is thus not surprising that some very general categories in Little's classification were inappropriate. Categories such as Personality and Sex Stereotype were those found to be inappropriate with the present, naturalistic data. In contrast, more specific categories such as Effort, Interest, Specific Ability and Time Spent were appropriate.

A second classification system which expanded those appropriate categories in Little's classification was developed. This is presented in Appendix 23. This classification had sixteen classes of attribution. These are presented in Table (25).

A pilot-test on a subsample of transcribed protocols indicated that this classification was satisfactory. All data was thus classified under these sixteen categories. All attributions made by a subject were included in the coding. Each was accorded equal status regardless of the order of presentation. A reliability check was made on the coding. A second coder classified a subsample of twelve protocols: four from each of the three age groups. Inter-coder reliability was 92%.

TABLE (25): CLASSES OF ATTRIBUTION TYPE

Strategy	1.	reading
	2.	learning/memory
	3.	recall
Effort	4.	concentration
	5.	time spent
Interest	6.	interest
Knowledge	7.	knowledge
Ability	8.	specific
	9.	general
Task Difficulty	10.	reading
	11.	test
Outcome	12.	referenced
Chance	13.	guessing
	14.	luck
Circumstance	15.	mood
	16.	situation

6.3 RESULTS: ATTRIBUTION

All data were analysed using the SPSSX statistical computing package.

6.3.1 Reading Time

As a preliminary investigation, reading times (measured in seconds) for each of the three age groups were compared. It was felt that this investigation would provide some evidence of comparability of the three age-graded passages. A one-way analysis of variance of reading time by age was conducted. The results indicated there was no significant difference in reading time between the three age groups ($F = 0.6312$; df 2,141, n.s). The result suggests the three passages were successfully age-graded and provides an index of their equivalence in terms of reading difficulty.

6.3.2 Learning Outcome

Three classes of learning outcome were examined: success, failure and other. The "other" category comprised those children in the external outcome definition group who attained a score defined as *"average for age"* by the standardised outcome definition and those children in the self-defined outcome definition group who described their result as neither a success nor a failure. Of this latter group, a range of terms were used to describe neither succeeding nor failing. Some children used the term *"average"* to convey this notion whilst others used more general terms such as *"just okay"* or *"in between"*.

Frequencies for Success, Failure and Other outcomes were examined for External and Self-defined Groups separately. These results are presented in Table (26).

TABLE (26): FREQUENCIES OF LEARNING OUTCOME DEFINED AS SUCCESS, FAILURE OR "OTHER" FOR EXTERNAL AND SELF-DEFINED GROUPS

	Learning Outcome			
	Success	Failure	Other	Total
External	36 (50%)	25 (35%)	11 (15%)	72 (100%)
Self-Defined	43 (60%)	21 (29%)	8 (11%)	72 (100%)
Total	79 (55%)	46 (32%)	19 (13%)	144 (100%)

Outcome definition for the External group was based on a normative scale (derived in Pilot Study 7) and should therefore have an equal distribution of success and failure scores. This was not the case, however. The results indicate an unequal distribution, with more subjects attaining a success rather than failure outcome.

Outcome definition for the Self-defined group evidenced a still greater inequality of distribution with 60% (n = 43) of these subjects defining their performance as success whilst only 29% defined their performance as failure. Of interest here is the choice of "other" as an outcome. Whilst only 11% of the subjects in the self-defined group chose this category, it does provide some indication that a dichotomy of learning outcome (success vs failure) is questionable. This group defined their performance as neither success nor failure despite the clear achievement orientation of the tasks and of the conditions under which they were performed.

6.3.3 DEFINITION OF LEARNING OUTCOME

To investigate the issue of outcome definition further, the range of scores used by subjects in the Self-defined group to define success, failure and "other" were examined. Ranges for each group were examined separately and the results compared with the normative scores used to define learning outcome for those subjects in the External Outcome Definition group. The results are reported in Table (27).

The results indicate that a wide range of scores was defined subjectively as "success" or "failure". A score as low as three was defined as success and a score as high as eight as failure, for example. Scores used to define the "other" category, however, approximated the mean score derived in the pilot study.
The results for each age separately indicate that the range of subjective definition decreases with age. This is particularly so with definitions of success where for seven year olds a range of seven scores was used to define success, whilst for nine and eleven year olds the range was as low as five and four respectively.

TABLE (27): RANGE OF SCORE USED TO DEFINE SUCCESS, FAILURE AND OTHER LEARNING OUTCOMES BY CHILDREN IN THE SELF-DEFINED GROUP

	Success	Failure	Other
<u>7 Years</u>			
Normative	≥7	≤5	6
Self-defined	3 - 10 (n = 16)	3 - 7 (n = 6)	3 - 6 (n = 2)
<u>9 Years</u>			
Normative	≥7	≤5	6
Self-defined	5 - 10 (n = 13)	3 - 6 (n = 7)	6 - 7 (n = 4)
<u>11 Years</u>			
Normative	≥8	≤6	7
Self-defined	6 - 10 (n = 14)	4 - 8 (n = 8)	6 - 7 (n = 2)
N	43	21	8

6.3.4 ATTRIBUTIONS

The analysis of attribution responses was conducted at two levels:

1. Attribution Type: each of the sixteen classes of attribution from the coding schedule were examined directly.

2. Attribution Dimension: raw attributions were then categorised along four dimensions reported in the Attribution literature:

   i. Locus (Leftcourt, 1982; Weiner, 1979; Kelly, 1967).

   ii. Stability (Weiner, 1979; Stratton et al., 1986).

   iii. Control (Weiner, 1979).

   iv. Specificity (Seligman et al., 1976; Stratton et al., 1986).

Each dimension was dichotomised thus:

TABLE (28): DICHOTOMY OF EACH ATTRIBUTION DIMENSION

Dimension	Polar dichotomy	
Locus	Internal:	cause originates from within the person
	External:	cause originates outside the person
Stability	Stable:	cause unchanging or difficult to change
	Unstable:	cause may be changed
Control	Control:	cause can be significantly influenced by the attributor
	Uncontrol:	cause is out of the control of the attributor
Specificity	Global:	cause is a general law or principle
	Specific	cause is specific to time and/or circumstances of the outcome

For each polar dimension, a new variable was created by aggregating those attribution types classified within it. For example, the Global variable was created by aggregating the number of attributions made for General Ability, Luck and Outcome - relative to that of others. Full details of the classification of attribution type into the eight dimensional variables are presented in Table (29).

TABLE (29): CLASSIFICATION OF ATTRIBUTION TYPE INTO FOUR DIMENSIONAL DICHOTOMIES

Dimension	Poles	
Locus of control	Internal strategy-reading strategy-learning strategy-recall concentration time spent interest knowledge mood specific ability general ability	External passage difficulty test difficulty outcome guessing luck situation
Stability	Stable general ability passage difficulty test difficulty	Unstable strategy-reading strategy-learning strategy-recall concentration time spent interest knowledge specific ability situation outcome guessing luck mood
Control	Controllable strategy-reading strategy-learning strategy-recall concentration time spent guessing	Uncontrollable interest knowledge specific ability general ability outcome luck situation mood passage difficulty test difficulty
Specificity	Specific specific ability strategy-reading strategy-learning strategy-recall concentration time spent interest knowledge guessing mood situation passage difficulty test difficulty	General general ability outcome luck

Frequencies

As an initial investigation, frequencies for both attribution type and dimension were examined.

Attribution Type

Frequencies for the sixteen classes of attribution type are presented in Table (30).

TABLE (30): FREQUENCIES OF ATTRIBUTION TYPE BY AGE GROUP AND FOR THE WHOLE SAMPLE

Attribution Type	Age			
	7	9	11	total
strategy reading	25	38	34	97
strategy learning	9	19	20	48
strategy recall	3	5	6	14
concentration	31	23	23	77
time spent	15	24	22	61
interest	0	1	6	7
knowledge	4	7	13	24
specific ability	3	5	3	11
general ability	2	5	1	8
passage difficulty	5	3	4	12
test difficulty	5	4	2	11
outcome	4	1	2	7
luck	1	2	2	5
guessing	0	0	2	2
mood	0	0	1	1
situation	0	1	2	3
Total	107	138	143	388

The distributions of frequencies across the sixteen categories varied greatly. The majority of responses, some 73%, comprised Effort (Time Spent and Concentration) and Strategy attributions. This result suggests the children's responses were largely situation-specific and is consistent with previous findings (Nicholls, 1983; Little, 1985).

Of the sixteen classes of attribution, nine were retained for further analysis. These were the nine most frequent attributions and each represented at least 3% of the total responses given.

Attribution Dimensions

The frequencies of each of the dimensions of attribution are presented in Table (31).

TABLE (31): FREQUENCIES OF ATTRIBUTION DIMENSIONS (N=388)

Dimension	Poles	
Locus of control	Internal 355	External 33
Stability	Stable 32	Unstable 356
Controllability	Controllable 304	Uncontrollable 84
Specificity	Specific 371	General 17

The results clearly indicate that for each dimension there is an unequal distribution of responses with the majority of responses being internal, unstable, controllable and specific.

Statistical Analyses

To investigate the relationship between the independent variables of Age, Processing Type, Outcome Definition and Learning Outcome, analyses of variance using a repeated measures design for attribution types was employed. Initially, a five-way analysis was conducted: Attribution Type (9 levels) x Age (3 levels) x Processing (2 levels) x Outcome Definition (2 levels) x Outcome (3 levels). This analysis failed, however, because a number of cells had zero entries. It was thus necessary to conduct two separate four-way analyses of variance of attribution type:

1. Attribution type (9 levels) x Age (2 levels) x Processing (2 levels) x Outcome Definition (3 levels).
2. Attribution type (9 levels) x Outcome (3 levels) x Processing (2 levels) x Outcome Definition (2 levels).

These analyses were also conducted for attribution dimensions (8 levels). The results of analyses for attribution type and attribution dimension are reported separately below.

Attribution Type

The four-way repeated measure analyses of variance by Age, Processing Type and Outcome Definition yielded three significant effects. Firstly, significant differences between attribution types emerged ($F = 49.92$, df 8,1040 $p < 0.01$). This result reflects the differing frequencies of attribution type and was expected. Secondly, an effect for attribution by age emerged ($F = 2.23$, df 16,1040 $p < 0.01$). Finally, an effect for attribution by Processing emerged ($F = 1.99$, df 8,1040 $p < 0.05$). No effects emerged for Outcome Definition. The four-way analyses of variance by Outcome, Outcome Definition and Processing Type yielded one further significant effect. The effects of Outcome were significant ($F = 2.2987$, df 16,1040, $p < 0.01$). No higher order effects emerged in either analysis.

Univariate techniques were employed to further examine the significant effects of Age, Processing Type and Outcome. A series of three-way analyses of variance (by Age, Processing and Outcome) was conducted. In each case the dependent variable was a single attribution type. Thus, a total of nine analyses were conducted.

Age Effects

Of the nine analyses, three yielded significant effects: Strategy-Reading, Strategy-Learning and Knowledge. The results are presented in Table (32).

TABLE (32): MEAN NUMBER OF ATTRIBUTIONS, ASSOCIATED F VALUES AND PROBABILITY OF F FOR THE ANALYSES OF VARIANCE OF STRATEGY-READING, STRATEGY-LEARNING AND KNOWLEDGE BY AGE

Age	Strategy Reading	Strategy Learning	Knowledge
7	0.52	0.19	0.08
9	0.79	0.40	0.15
11	0.74	0.43	0.28
F (df 2,104)	4.680	3.997	3.660
p	<0.01	<0.05	<0.05

Cell means indicate that, for both Reading- and Learning-Strategy, the age effects derive from the smaller mean of the seven year olds compared with the other two groups. Cell means for Knowledge attributions appear to follow a linear pattern, however, with attributions to prior knowledge increasing with age.

Processing Effects

Two processing effects emerged from the analyses of variance. These were for the Knowledge and Ability attributes. The results are reported in Table (33).

TABLE (33): MEAN NUMBER OF ATTRIBUTIONS, ASSOCIATED F VALUES AND PROBABILITY OF F FOR ANALYSES OF VARIANCE OF KNOWLEDGE AND SPECIFIC ABILITY BY PROCESSING

	Knowledge	Specific Ability
Verbatim	0.08	0.12
Meaning	0.26	0.03
F (df 2,104)	7.700	4.445
p	<0.01	<0.05

The results indicate that attributions to prior Knowledge are greater for subjects in the Meaningful processing condition than for those in the Verbatim condition. In contrast, attribution to Specific Ability is greater for those in the Verbatim condition.

The results together clearly reflect the effects of different processing orientations in directing attribution. Those children in the Meaning orientation have been directed toward understanding for which links with existing knowledge are necessitated (Ausubel 1968), whilst those subjects in the Verbatim condition were engaged in an isolated memory task where emphasis on the ability to rote learn was paramount.

Outcome Effects

An effect for outcome emerged for the Time Spent attribution. The results are presented in Table (34).

TABLE (34): MEAN NUMBER OF ATTRIBUTIONS, ASSOCIATED F VALUES AND PROBABILITY OF F FOR THE ANALYSIS OF VARIANCE OF TIME SPENT BY OUTCOME.

	Success	Failure	Other
Cell means	0.31	0.64	0.42
F= 6.731	(df 2,104)		p<0.001

The results indicate that a significantly larger number of attributions for Time Spent were made when a Failure result occurred than for either Other or Success outcomes.

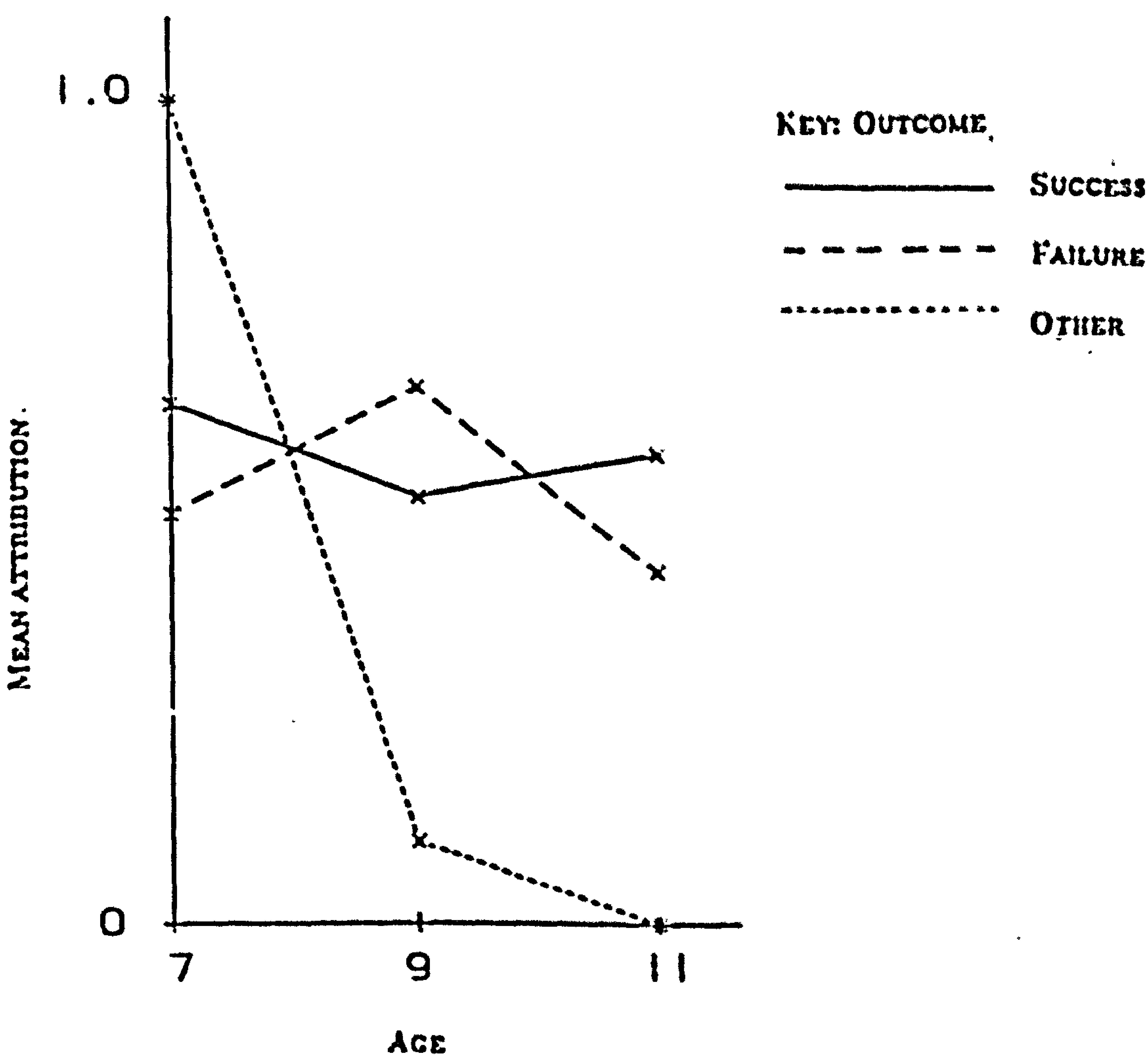
Higher Order Interactions

Analyses of variance yielded two higher order interactions, both of which related to the two effort attribution types: Time Spent and Concentration. An Age x Outcome effect emerged for Concentration attributions. The results are reported in Table (35) and Figure 1.

TABLE (35): F VALUE AND ASSOCIATED PROBABILITY OF F FOR THE ANALYSIS OF VARIANCE OF EFFORT-CONCENTRATION WITH AGE AND OUTCOME

Effect	df	F	p
Age	(2,104)	1.670	n.s
Outcome	(2,104)	0.956	n.s
Age x Outcome	(4,104)	3.161	<.01

FIGURE 1: MEAN ATTRIBUTION TO CONCENTRATION FOR SUCCESS, FAILURE AND OTHER LEARNING OUTCOMES



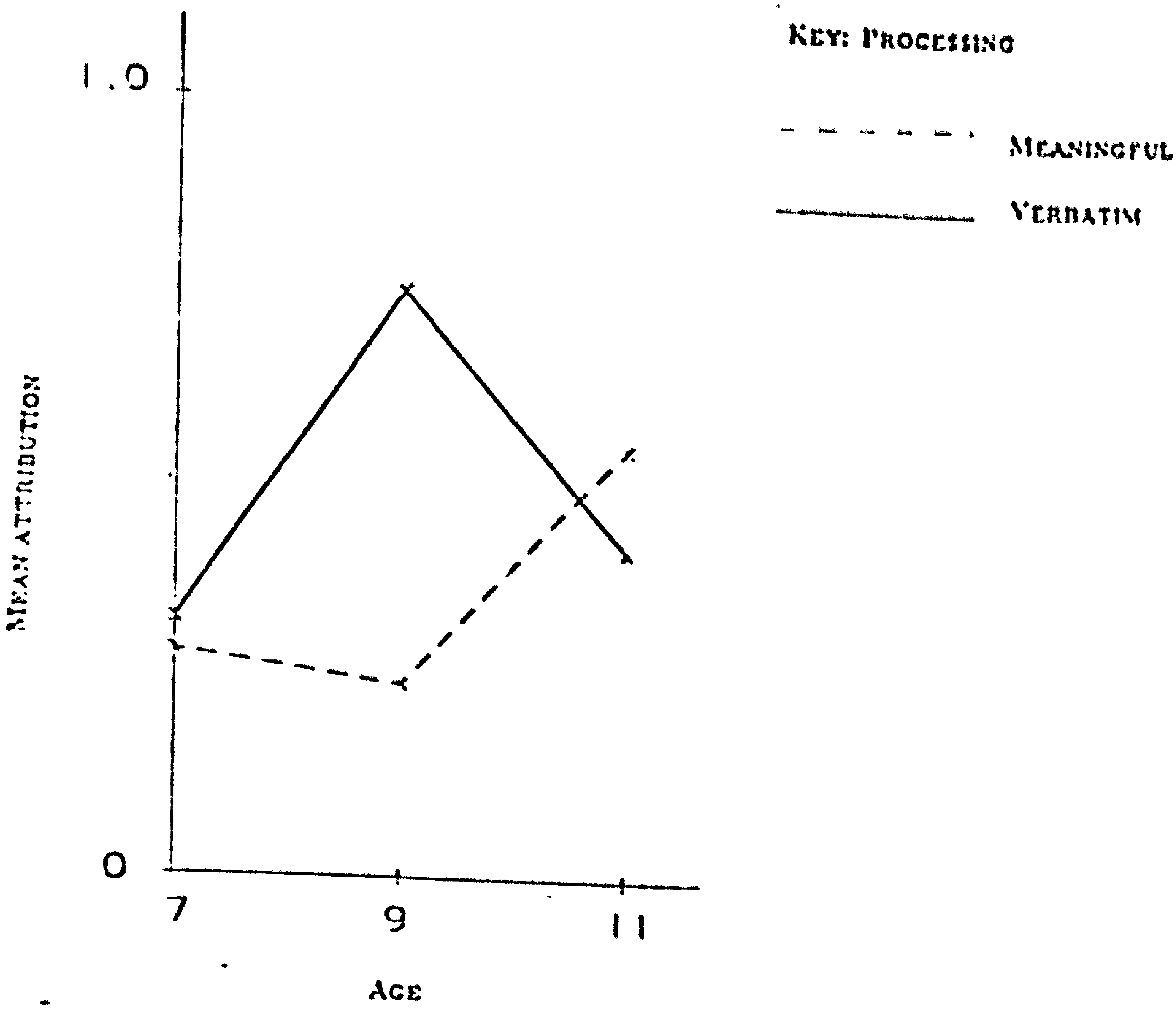
The graph indicates that seven year olds who attained an "other" learning outcome, attribute this to a factor of Concentration significantly more than nine or eleven year olds who attained an "other" outcome. The means for attribution to Concentration for children who attained a success or failure outcome were proximate. There was, however, a curvilinear trend with development. Whilst for both the seven and eleven year olds failure was less likely to be attributed to Concentration, for the nine year olds the opposite was true.

An age by processing interaction emerged for the Time Spent attribution type. The results are presented in Table (36) and in Figure 2.

TABLE (36): F VALUE AND ASSOCIATED PROBABILITY OF F FOR THE ANALYSIS OF VARIANCE OF EFFORT-TIME SPENT WITH AGE AND PROCESSING.

Effect	df	F	p
Age	2,104	2.186	n.s
Processing	1,104	3.190	n.s
Age x Processing	2,104	5.405	<.05

FIGURE 2: ATTRIBUTION TO TIME SPENT WITH AGE AND PROCESSING TYPE



The graph indicates there are two explanations of interaction. Firstly, whilst seven and eleven year olds maintain a relatively stable level of attribution to Time Spent across the two processing groups, the nine year olds in the Verbatim processing group evidence significantly greater attributions to Time Spent than those in the Meaning processing group. Secondly, the direction of the means for eleven year olds is opposite to those of seven and nine year olds. Whilst the mean attribution to Time Spent was lower for seven and nine year olds in the Meaning processing group, the opposite was true for eleven year olds.

Attribution Dimensions

The four-way analyses of variance of the Attributions Dimension (repeated measures) x Age x Processing x Outcome Definition yielded three significant effects. Again, Attribution ($F=342.96$, df 14,910, $p<0.001$), Age ($F=5.41$, df 14,910, $p<0.01$) and Processing ($F=4.53$, df 7,910, $p<.01$) emerged as significant. The analysis by Processing, Outcome Definition and Outcome yielded no further effects. Outcome was not found to be significant in the analysis of attribution dimensions. Again, no higher order interactions emerged.

The effects of Age and Processing were further examined via univariate techniques. A series of two-way analyses of variance of attribution type by Age and Processing were conducted. In each case the independent variable was a pole of the the four dimensions. Thus eight analyses were conducted.

Age effects

The analyses yielded an Age effect on four variables. These were Internal, Specific, Control, and Unstable. The results are presented in Table (37).

TABLE (37): MEAN NUMBER OF ATTRIBUTIONS, ASSOCIATED F VALUES AND PROBABILITY OF F FOR THE ANALYSES OF VARIANCE OF INTERNAL, SPECIFIC, CONTROL AND UNSTABLE ATTRIBUTIONS WITH AGE

Age	Internal	Specific	Control	Unstable
7	1.94	2.10	1.75	1.98
9	2.69	2.75	2.31	2.62
11	2.85	2.96	2.33	2.91
F (df 2,104)	9.215	5.993	4.302	8.355
P	<0.001	0.01	0.05	0.001

Cell means indicate that in each case there is an increase in attributions which are Internal, Specific, Controllable and Unstable, commensurate with age.
The results suggest that while attributions for all age groups were Internal, Unstable, Controllable and Specific, this pattern becomes more evident with age. This result may be partly due to quantitative differences, however. It may be that older children make more attributions for the same learning outcome.

Processing Effects

Analyses yielded four significant processing effects. These were once again for the four dimensional attribution variables: Internal, Unstable, Controllable and Specific. The results are reported in Table (38).

TABLE (38): MEAN NUMBER OF ATTRIBUTIONS, F VALUES AND PROBABILITY OF F FOR THE ANALYSES OF VARIANCE OF INTERNAL, SPECIFIC, CONTROL AND UNSTABLE ATTRIBUTIONS WITH PROCESSING

	Internal	Specific	Control	Unstable
Verbatim	2.69	2.83	2.36	2.72
Meaning	2.27	2.36	1.89	2.27
F (df 1,104)	5.044	5.027	6.668	5.384
P	<0.05	<0.05	<0.01	<0.05

Cell means indicate that means for the Verbatim processing group exceeded those of the Meaning group in each case.

Higher order Interactions

No higher order effects emerged in the analyses of dimensional attribution types.

In summary, the analyses of attributions indicate that:

(1) Differences between experimenter and self-defined learning outcomes do occur. Across the whole sample, a greater proportion of children in the self-defined group defined themselves as successful than would be defined as such by a normative definition. Definition of Success became more proximate to the normative with age, however. Definition of Failure approximated that of the normative for nine year olds. Some eleven year olds defined scores as high as eight out of ten as a failure.

(2) A small group of children in the self-definition condition described their learning outcome as neither a success nor failure, despite the clear achievement orientation of the task presented and the open-ended format of outcome definition.

(3) Of the sixteen classes of attribution type, nine were identified as substantial categories which accounted for at least 3% of the total attributions. Most frequently used categories were those pertaining to Strategy and Effort. Age differences in the use of attribution type to explain learning outcome emerged for three attribution classes: Strategy-Reading, Strategy-Learning, Knowledge.

(4) Processing effects emerged for Knowledge and Ability attribution types whilst Outcome effects emerged for Effort - Time Spent. Higher order effects emerged for both Effort attribution types: Concentration and Time Spent.

(5) Age effects emerged for attribution dimensions indicating that attributions made were more Internal, Specific, Controllable and Unstable with increased age.

(6) Processing effects emerged for attribution dimensions indicating that, following Verbatim processing, attributions were more Internal, Specific, Controllable and Unstable than those following Meaningful processing.

6.4 THE RESULTS: ATTRIBUTION AND METACOGNITION

To examine the relationship between metacognition - as measured by the eight metacognitive indices - and attributions for learning outcome, a series of correlational studies were conducted. Using Pearson's correlation coefficient, each metacognitive index was correlated with attribution type and attribution dimension. Initially, these correlations were calculated for each age group separately. The results of these analyses are presented in Appendix (24) and are summarised in the following discussion and tables.

6.4.1 Correlation Studies by Age

Attribution Type and Metacognition

A summary of the number count of significant correlations ($p<0.05$) of attribution type with metacognitive indices is presented in Table (39).

TABLE (39): SUMMARY OF THE NUMBER OF SIGNIFICANT CORRELATIONS OF EIGHT METACOGNITIVE INDICES WITH EACH ATTRIBUTION TYPE

	Age			
Metacognitive Index	7	9	11	Total
CATTOT	0	2	0	2
SPCTOT	1	1	1	3
RAT2	1	1	2	4
GSEHS	5	1	0	6
GSAM	3	3	2	8
GSCM	1	2	3	6
OS	3	1	1	4
THS	0	0	2	2
Number significant	14	11	11	35
Total	72	72	72	216
Percent significant	19	15	15	16

The results present a picture of a generally weak relationship between the eight metacognitive indices and each attribution type with only 16% of the total correlations attaining significance and the highest single significant correlation being 0.48. Moreover, of the non-significant correlations, some were negative.

Variation in correlations matrices for each age group emerged, indicating developmental changes in the relationship between the eight metacognitive indices and attribution type.

Attribution Dimension and Metacognition

A summary of the number of significant correlations of attribution dimension and the eight metacognitive indices is presented in Table (40).

TABLE (40): SUMMARY OF THE NUMBER OF SIGNIFICANT CORRELATIONS OF THE EIGHT METACOGNITIVE INDICES WITH EACH POLE OF ATTRIBUTION DIMENSIONS

Metacognitive Index	Age 7	9	11	Total
CATTOT	1	4	0	5
SPCTOT	0	4	3	7
RAT2	0	0	3	3
GSEHS	4	0	1	5
GSAM	4	0	0	4
GSCM	4	0	0	4
OS	5	0	0	5
THS	0	0	1	1
Significant r	18	8	8	34
Total	64	64	64	192
Percent	28	8	8	18

Again, results indicate a generally weak relationship with only 18% of the total number of correlations attaining significance and the highest single correlation being 0.38. Age differences in the pattern of correlation were marked. The results for the seven year olds indicated a much stronger relationship between attribution dimension and the metacognitive indices than those of the nine and eleven year olds. Of the correlations for the seven year olds, 28% were significant compared with 12.5% of the nine and eleven year olds. Again, patterns of significant correlations varied across the three separate age matrices.

6.4.2 CORRELATION STUDIES FOR THE WHOLE SAMPLE

To ascertain the relationship between the metacognitive indices and attribution for the whole sample, meta-analyses of the correlation matrix for each age separately were performed for both attribution type and attribution dimension. In view of the variation in direction and size of correlations in the separate age matrices, a meta-analysis was selected as preferable to a simple correlation of metacognitive scores and attribution across the whole sample. Raw correlations for each of the separate age studies were transformed into Fisher's Z values (Ferguson, 1976: p184) and the mean of the age-dependent correlations then calculated. The results are presented in Appendix 25 and a count of significant correlations presented in Table (41) below.

TABLE (41): SUMMARY OF THE NUMBER OF SIGNIFICANT CORRELATIONS FOLLOWING META-ANALYSES OF: (A) ATTRIBUTION TYPE WITH METACOGNITIVE INDICES (B) ATTRIBUTION DIMENSION WITH METACOGNITIVE INDICES

	Meta-analysis	
Index	Attribution type	Attribution dimension
CATTOT	1	1
SPCTOT	0	0
RAT2	1	3
GSEHS	1	1
GSAM	4	4
GSCM	2	2
OS	2	4
THS	0	0
Total	11 (15%)	15 (25%)

The results of the meta-analysis again reflect a generally weak relationship between the eight metacognitive indices and the children's attribution for learning outcome. This finding is not surprising: it reflects the selection criteria of "distinctiveness" used in deriving metacognitive indices.

Individual metacognitive indices vary in the extent to which they predict attribution type. Of the eight indices, GSAM, OS and RAT2 correlate most highly with attribution. It was thus decided to focus on these indices in subsequent analyses which examined the interaction of the experimental conditions with metacognition and attribution.

A new metacognitive variable, MCA, was created by aggregation of the three selected indices. Resultant MCA scores were ranked and used to designate three groups which were as closely as possible of equal size. These groups were designated as "high", "medium" and "low" levels of metacognition. The three levels of MCA were cross-tabulated with age to examine their relationship. The results are presented in Table (42).

TABLE (42): CROSS-TABULATION OF MCA WITH AGE

	Number of Children in each Metacognitive level			
Age	low	medium	high	Total
7	31	16	1	48
9	17	15	15	47
11	2	15	29	46
	50	46	45	141

The results of cross-tabulation show a clear developmental trend of increased metacognitive level with age. This finding was not unexpected. It signifies that the variable MCA is confounded with age. MCA is, in this sense, an absolute measure of metacognition which incorporates the effects of development as well as those of individual difference. In initial examination of the interaction of metacognition and experimental conditions with attribution, the variable MCA represented metacognition. In subsequent analyses (described later), age was partialled out of the metacognitive variable to form a new, "relative" metacognitive variable, MCZ.

6.4.3 INTERACTION OF PROCESSING, OUTCOME DEFINITION AND RESULT WITH ABSOLUTE METACOGNITION (MCA) AND ATTRIBUTION

In order to investigate how the experimental conditions Processing and Outcome Definition and the independent variable Learning Outcome relate to metacognition (MCA) and attribution, analysis of variance methods were employed. Two four-way analyses were conducted for each attribution type and each attribution dimension:

1) *Attribution type* x (MCA (3 levels) x Processing (2 levels) x Outcome Definition (2 levels) x Outcome (3 levels))

2) *Attribution Dimension* x (MCA (3 levels) x Processing (2 levels) x Outcome Definition (2 levels) x Outcome (3 levels))

The results are summarised below.

Attribution Type

The analyses of variance of attribution type by MCA, Processing, Outcome Definition and Outcome yielded three main effects. These were for MCA with Strategy-Reading, Strategy-Learning and Specific Ability. The results are summarised in Table (43).

TABLE (43): MEAN NUMBER OF ATTRIBUTIONS, F VALUES AND ASSOCIATED PROBABILITIES OF F FOR THE ANALYSES OF VARIANCE OF STRATEGY-READING, STRATEGY-LEARNING AND SPECIFIC ABILITY WITH MCA

		Strategy Reading	Strategy Learning	Specific Ability
	L	0.54	0.20	0.00
Metacognitive level (MCA)	M	0.67	0.33	0.09
	H	0.84	0.51	0.16
F (df 2,109)		5.45	5.01	3.68
P		<0.01	<0.01	<0.05

Cell means indicate that, in each case, there is an increased use of each attribution type as metacognitive level increases.

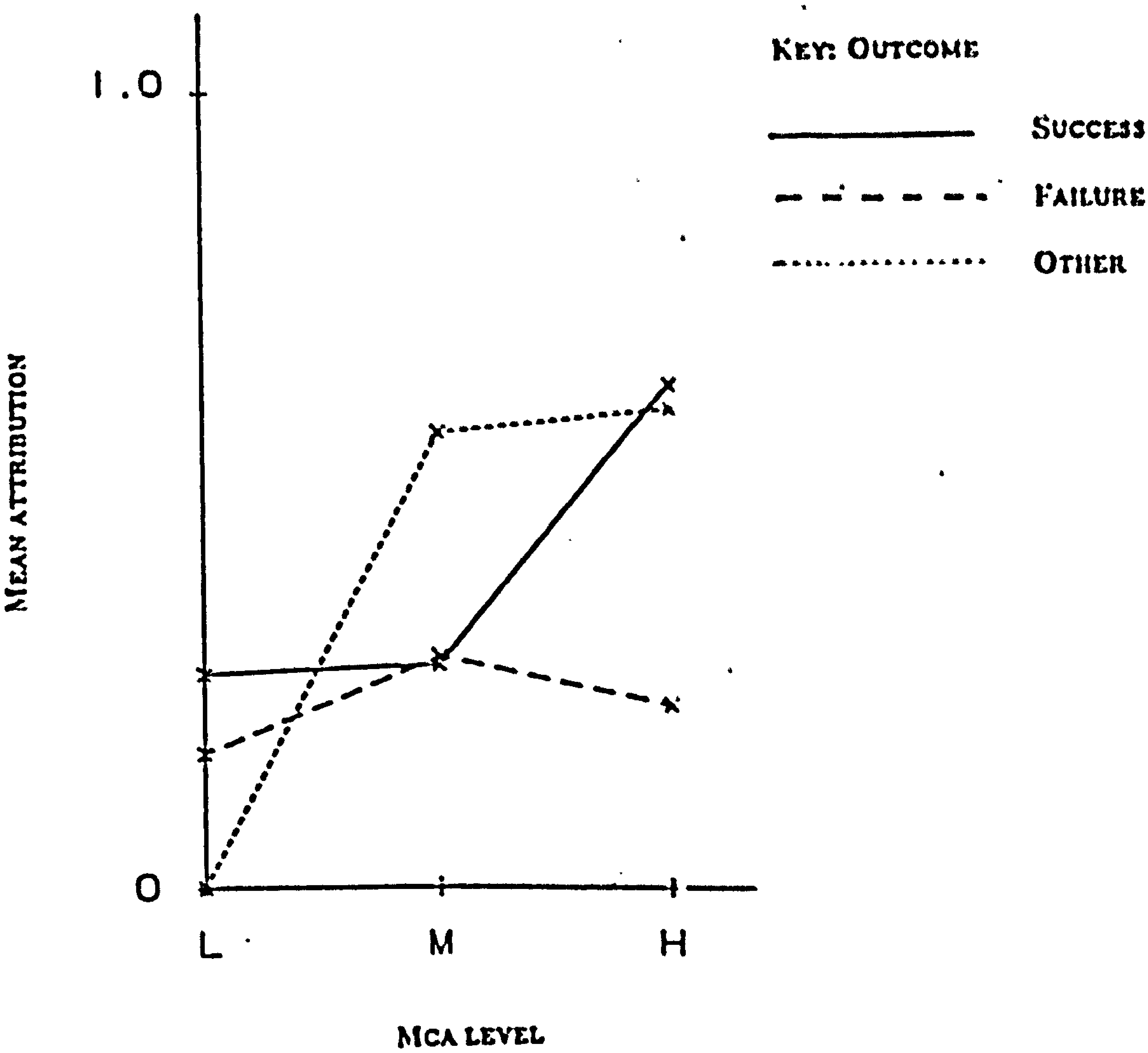
The analyses of variance yielded three higher order interactions. The results are summarised in Table 44).

TABLE (44): SUMMARY OF THE SIGNIFICANT HIGHER ORDER INTERACTIONS FROM THE ANALYSES OF VARIANCE OF ATTRIBUTION TYPE (MCA x PROCESSING x OUTCOME DEFINITION x OUTCOME)

Attribution Type	Interaction	F	df	P
Strategy Learning	MCA x Outcome	2.47	2,109	<0.05
Effort-Conc.	MCA x Processing	8.76	2,109	<0.01
Knowledge	MCA x Processing x Outcome	3.72	4,109	<0.01

The interaction of MCA with Outcome for Strategy Learning is presented in Figure 3.

FIGURE 3: ATTRIBUTION TO STRATEGY-LEARNING WITH MCA OUTCOME

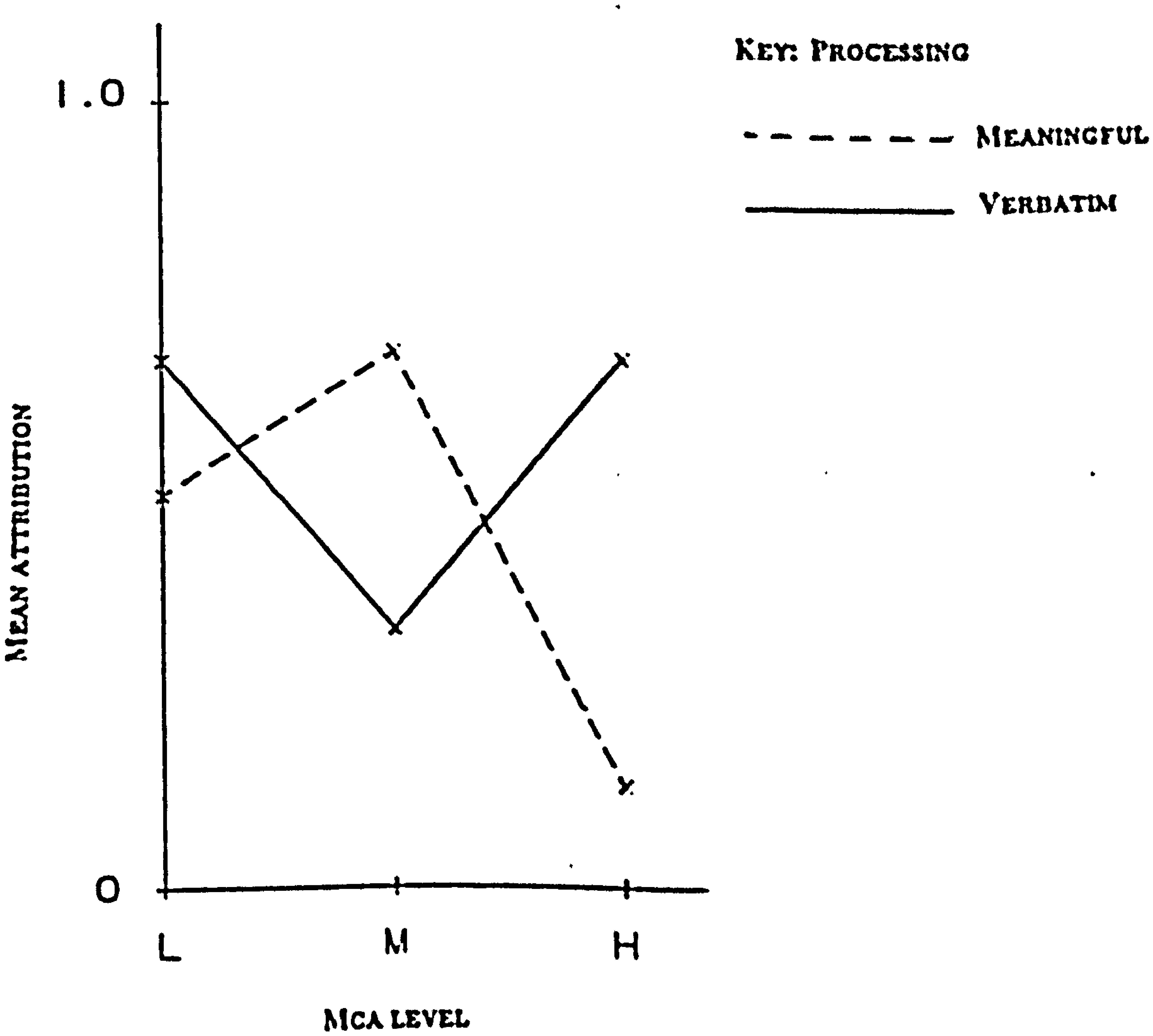


The graph indicates that, for those children whose learning outcome was success, a greater number of attributions to Strategy-Learning are made by children in the highest MCA level. For those children whose learning outcome was failure, attribution to Strategy-Learning is relatively stable across the three levels of MCA.

For those children whose learning outcome was "other", no attribution was made to Strategy-Learning by children in the lowest MCA level. However there was a substantial increase for medium and high MCA levels. The results generally indicate that attribution to Learning Strategy increases as MCA level increases particularly for success and "other" outcomes.

The interaction of MCA with processing for the Effort-Concentration attribution type is presented in Figure 4.

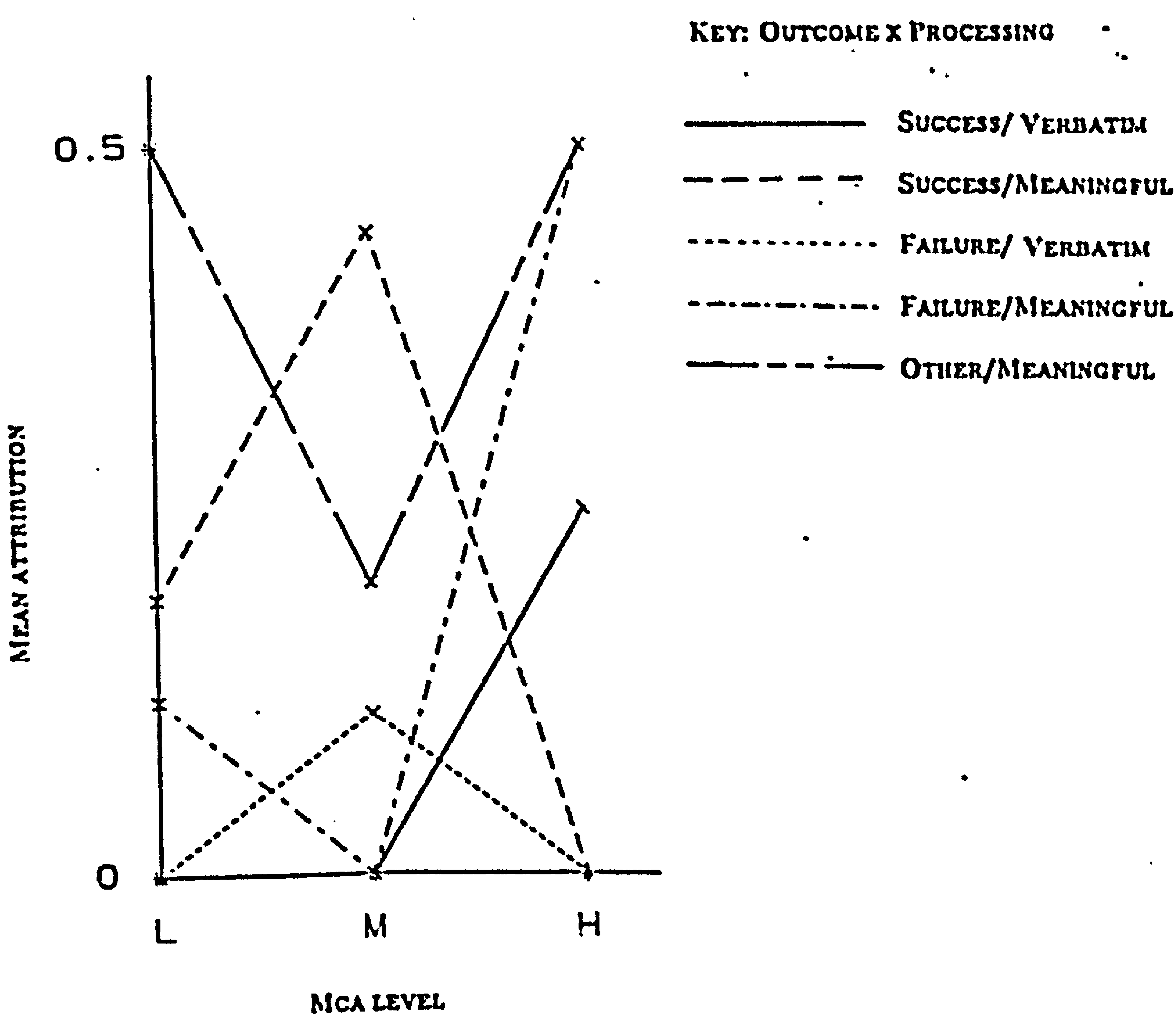
FIGURE 4: ATTRIBUTION TO EFFORT-CONCENTRATION WITH MCA AND PROCESSING



The results present a clear, non-linear pattern with children in the middle metacognitive group responding differently from the other two groups in each case. The mean attribution for Effort-Concentration is lowest for the members of this group in the Verbatim condition and highest for those in the Meaning condition. The difference between processing groups is greatest for the high metacognitive group, however. For this group, the highest mean number of attribution is made for those in the Verbatim condition, whilst a very low level of attribution to Concentration is made for those in the Meaning processing condition.

The interaction of MCA with Processing and Outcome for Knowledge attribution type is presented in Figure 5.

FIGURE 5: MEAN ATTRIBUTION TO KNOWLEDGE WITH MCA, PROCESSING AND OUTCOME



The graph in Figure 5 presents a complex set of interactions. It indicates that, except in the case of Other-Verbatim group in which no child made an attribution for Knowledge, there is a non-linear pattern with the medium metacognitive group producing a different pattern of response. The mean number of attributions to Knowledge for children in the Verbatim processing condition who attained a success learning outcome was highest for those in the high metacognitive group. Those in the Meaningful group showed a curvilinear trend with highest means in the medium metacognitive group. Children in both processing conditions whose outcome was a failure produced non-linear patterns of attribution to Knowledge. In the case of the Verbatim group a curvilinear trend was revealed, with only children in the middle metacognitive group making Knowledge attributions. In contrast to the children in the Meaning processing condition, the middle metacognitive group was the only one in which no attributions to Knowledge were made. The pattern of response for children in the Other-Meaning group was curvilinear with both the low and high metacognitive groups making higher mean attributions to Knowledge than the middle group.

Attribution Dimensions

The analyses of variance of attribution dimension (MCA x Processing x Outcome Definition x Outcome) yielded five significant main effects for MCA and a further higher order interaction.

MCA effects emerged for Internal, Control, Uncontrol, Unstable, and Specific dimensions. The results are presented in Table (45).

TABLE (45): MEAN NUMBER OF ATTRIBUTIONS, F VALUES AND ASSOCIATED PROBABILITIES OF F FOR THE ANALYSES OF VARIANCE OF INTERNAL, CONTROL, UNCONTROL, UNSTABLE AND SPECIFIC ATTRIBUTION DIMENSIONS WITH MCA

		Internal	Control	Uncontrol	Unstable	Specific
	L	1.94	1.76	0.36	1.94	2.00
MCA	M	2.54	2.15	0.61	2.54	2.67
	H	3.02	2.49	0.84	3.07	3.18
F df 2,109		10.17	4.31	3.75	10.35	9.48
P		<0.001	<0.05	<0.05	<0.001	<0.001

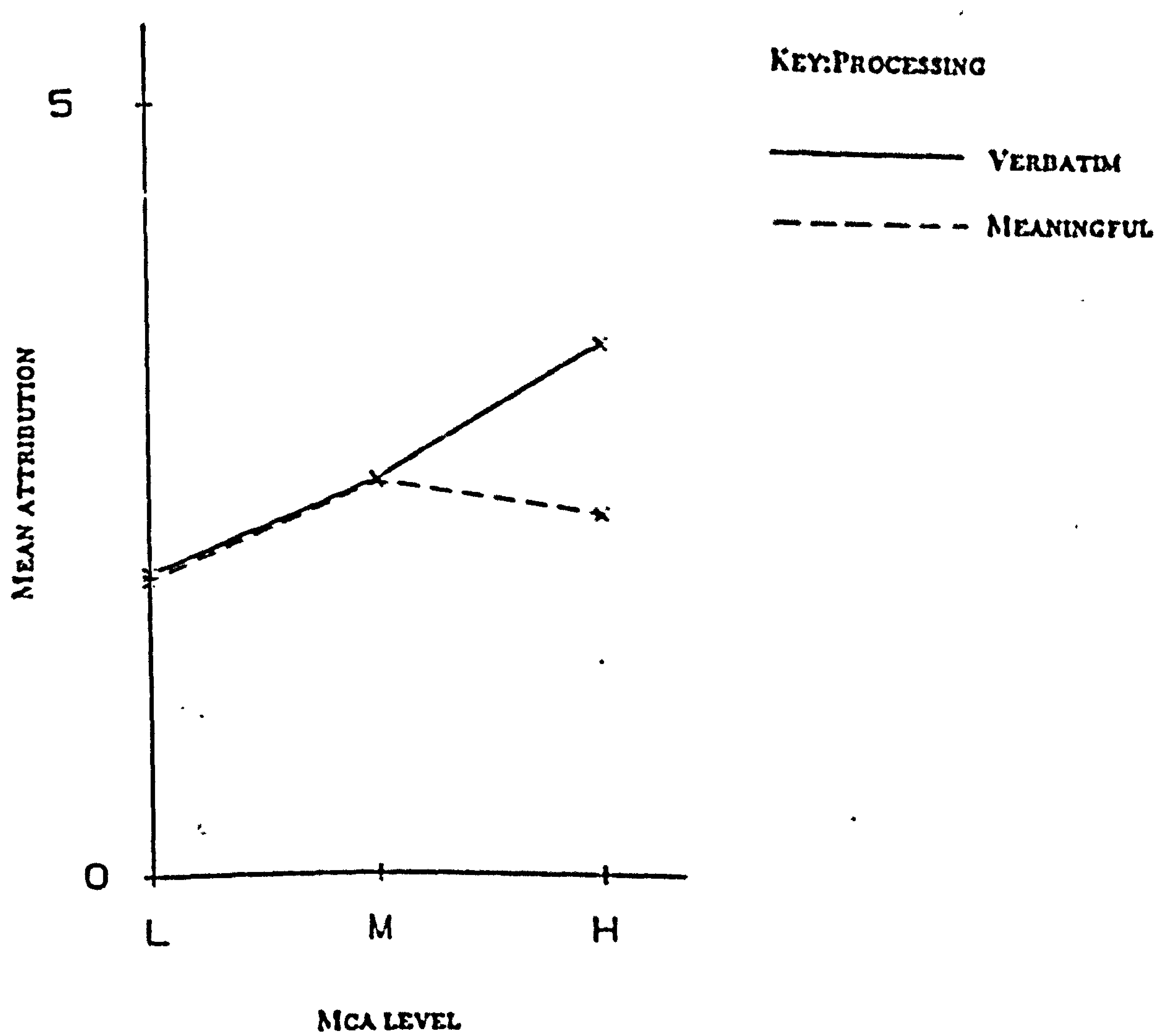
In all cases, cell means indicate a linear trend with attribution to Internal, Controllable, Uncontrollable, Unstable and Specific causes increasing as level of MCA increases.

A higher order interaction emerged for the unstable attribution dimension. The results are reported in Table (46) and presented in Figure 6.

TABLE (46): SUMMARY OF THE HIGHER ORDER INTERACTIONS OF THE UNSTABLE ATTRIBUTION DIMENSION WITH MCA AND PROCESSING

	F	df	P
MCA	10.35	1,109	<0.001
Processing	3.31	2,109	n.s
MCA x processing	3.30	2,109	<0.05

FIGURE 6: MEAN UNSTABLE ATTRIBUTION WITH MCA AND PROCESSING



The graph indicates that the interaction derives from the divergent behaviour of processing groups with high metacognitive level. Those children with a high metacognitive level in the Verbatim processing group increase their attribution to unstable causes compared with other metacognitive groups, whilst those in the Meaning processing group present the opposite trend.

In summary, the analyses of variance of attribution type with MCA and the experimental variables indicate that these variables do interact. Attributions of learning outcome to Reading and Learning Strategies and Specific Ability all increase commensurate with MCA. In the case of Learning Strategy, this pattern is further affected by the learning outcome attained. Effort-Concentration and Knowledge, whilst not significantly different in terms of MCA alone, do interact with the experimental conditions of Processing and Outcome. The results indicate that learning context (here defined by Processing and Outcome Definition) can affect patterns of attribution and this is mediated through the level of the metacognitive understanding of the child.

The results of the analyses of variance of attribution dimension (MCA x processing x Outcome Definition x Outcome) present a clearer picture of this relationship. They indicate that children's attributions for learning outcome become more Internal, Unstable and Specific with increased MCA level. Moreover, the results suggest that with increased MCA, children have a greater awareness of the effects of both controllable and uncontrollable elements in the learning context and combine these in the explanation of their successes, failures or otherwise.

6.4.4 INTERACTION OF PROCESSING, OUTCOME DEFINITION AND OUTCOME WITH RELATIVE METACOGNITION (MCZ) AND ATTRIBUTION

The results of the analyses with MCA presented a picture comparable to the naturalistic setting where development and level of metacognition are confounded. It was of interest here, however, to examine the effects of metacognition with developmental effects controlled to ascertain the contribution of metacognitive awareness *per se* to attribution. To this end, given that the standard deviations for the three groups were comparable, MCA scores were standardised for each age group separately to express all scores in standard deviation units (Z scores). The total distribution of the scores was then split into groups of roughly equal size corresponding with "high" "medium" and "low" levels of MCA. The resultant variable, MCZ, was thus controlled for the effects of age. The grouping was based on metacognitive level relative to age. The analyses of variance of Attribution Type and Attribution Dimension by Metacognition, Processing, Outcome Definition and Outcome were repeated with the new metacognitive variable grouping. The results are reported below.

Attribution Type

The results of the analyses of variance of Attribution Type by MCZ, Processing, Outcome Definition and Outcome yielded one main effect and three higher order interactions with MCZ.

A main effect emerged for the Specific Ability attribution type. The results are presented in Table (47).

TABLE (47): MEAN NUMBER OF ATTRIBUTIONS, F VALUES AND ASSOCIATED PROBABILITY OF F FOR THE ANALYSIS OF VARIANCE OF SPECIFIC ABILITY WITH MCZ

MCZ level	low	medium	high
attributions	0.00	0.02	0.20
F= 8.28	df 2,108		$p<0.001$

Cell means indicate there is a marked increase in attributions to Specific Ability with higher metacognitive level, after control for age.

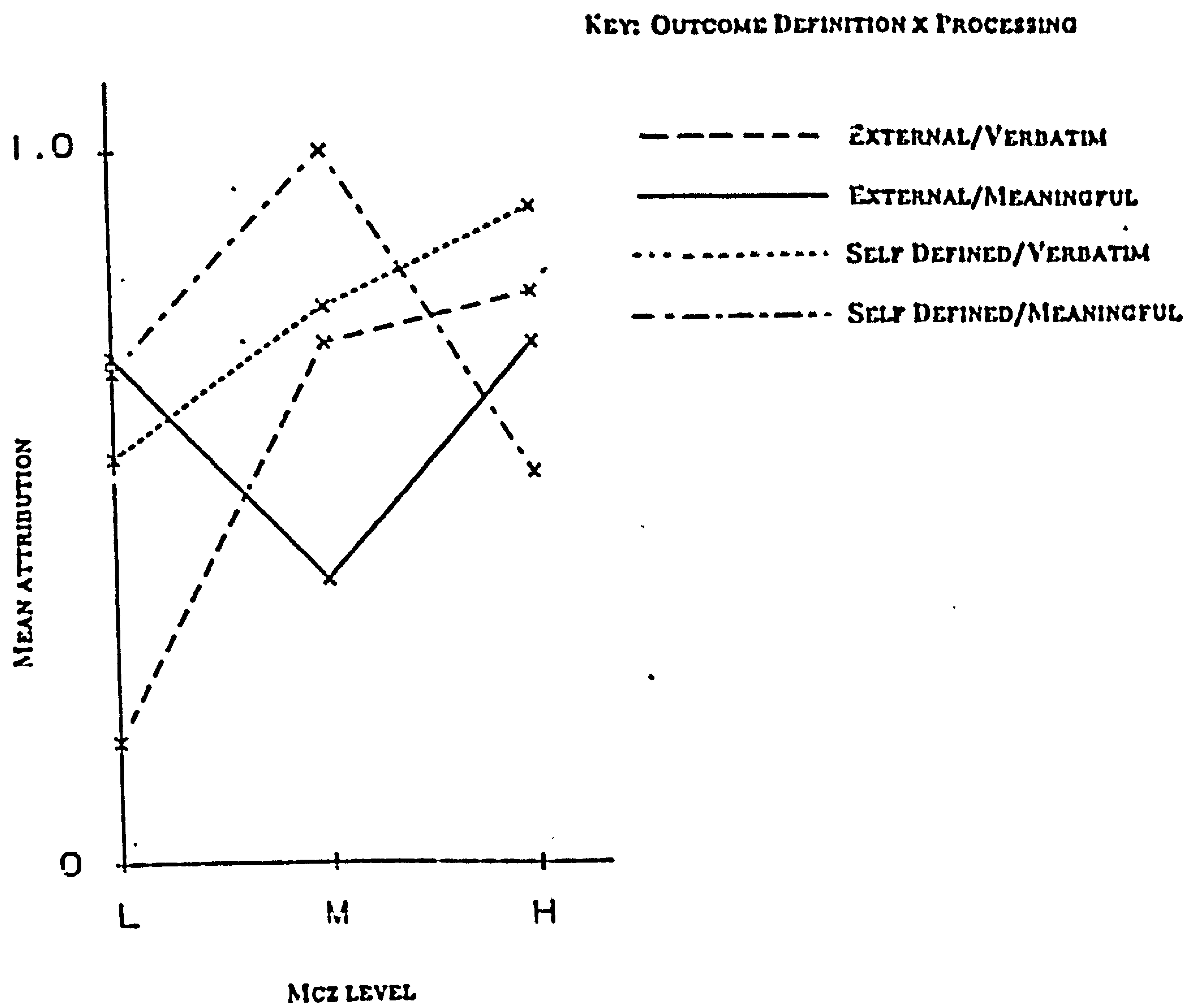
A summary of the higher order interactions is presented in Table (48).

TABLE (48): SUMMARY OF SIGNIFICANT HIGHER ORDER INTERACTIONS FROM THE ANALYSES OF VARIANCE OF ATTRIBUTION TYPE (MCZ x PROCESSING x OUTCOME DEFINITION x OUTCOME)

Attribution Type	Interaction	F	df	P
Strategy Reading	MCZ x Processing x Outcome Definition	3.62	2,108	<0.05
Strategy Learning	MCZ x Outcome Definition	5.40	2,108	<0.01
Effort Time Spent	MCZ x Outcome	2.61	4,108	<0.05

The interaction of MCZ with Processing and Outcome Definition for Strategy-Reading attribution type is presented in Figure 7.

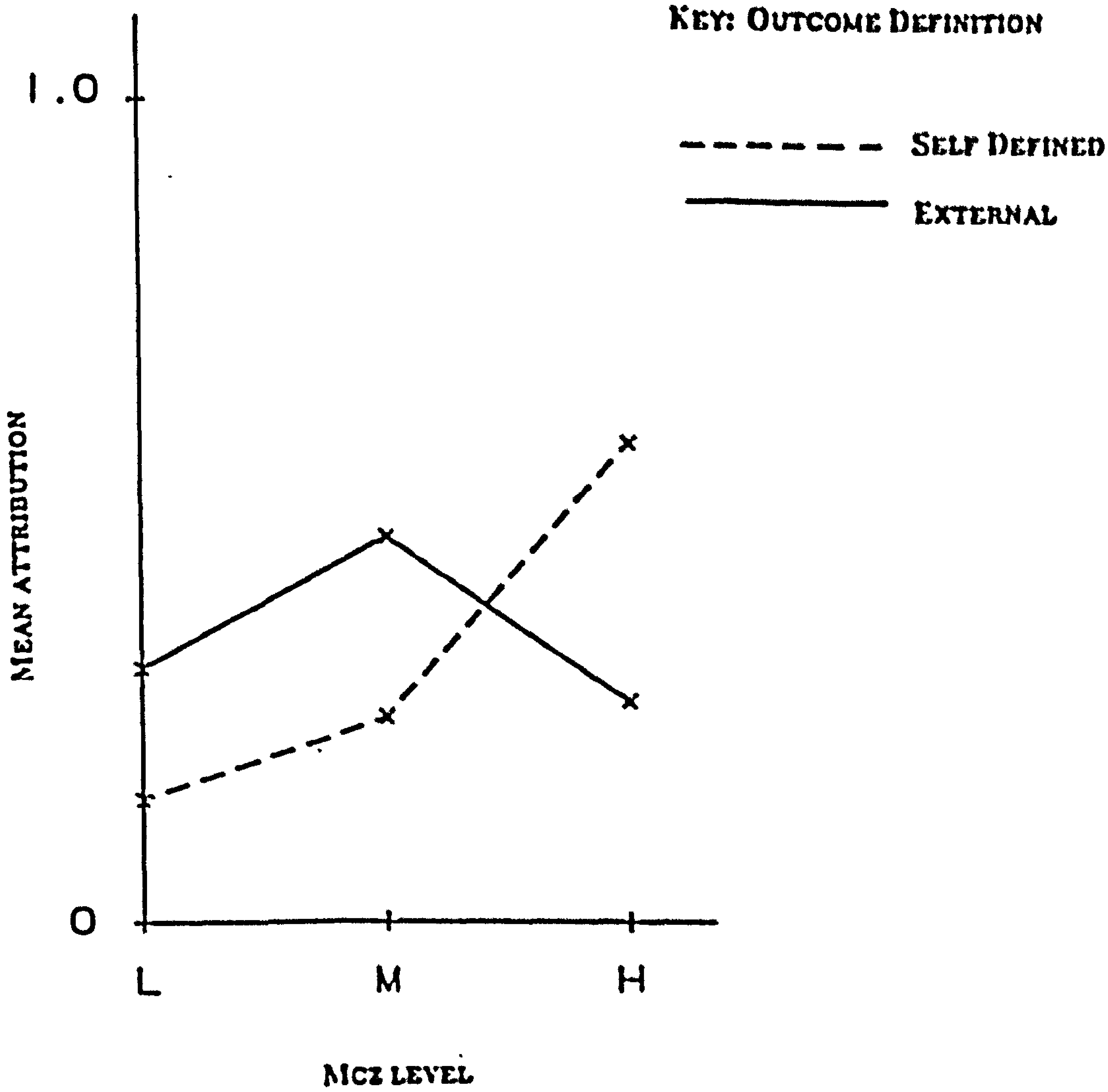
FIGURE 7: MEAN ATTRIBUTIONS TO STRATEGY-READING WITH MCZ, PROCESSING AND OUTCOME DEFINITION



The graph indicates that those children in the Verbatim processing condition make greater attribution to Strategy Reading with higher metacognitive level regardless of the Outcome Definition condition they experienced. For children in the Meaning processing group, however, responses are not likewise consistent. Here the outcome definition groups produced opposite response trends. Children in the experimenter-defined outcome group demonstrate a curvilinear pattern of response with the middle MCZ group attaining the lowest mean attribution to Strategy Reading. In contrast, those in the self-defined outcome group produced a curvilinear response pattern in the opposite direction with the middle MCZ group scoring the highest mean. The results suggest that for attribution to Strategy Reading, Outcome Definition has an effect only for those in the Meaning processing condition and particularly for those at the middle, metacognitive level.

The results of the interaction of MCZ and Outcome Definition for Strategy Learning are presented in Figure 8.

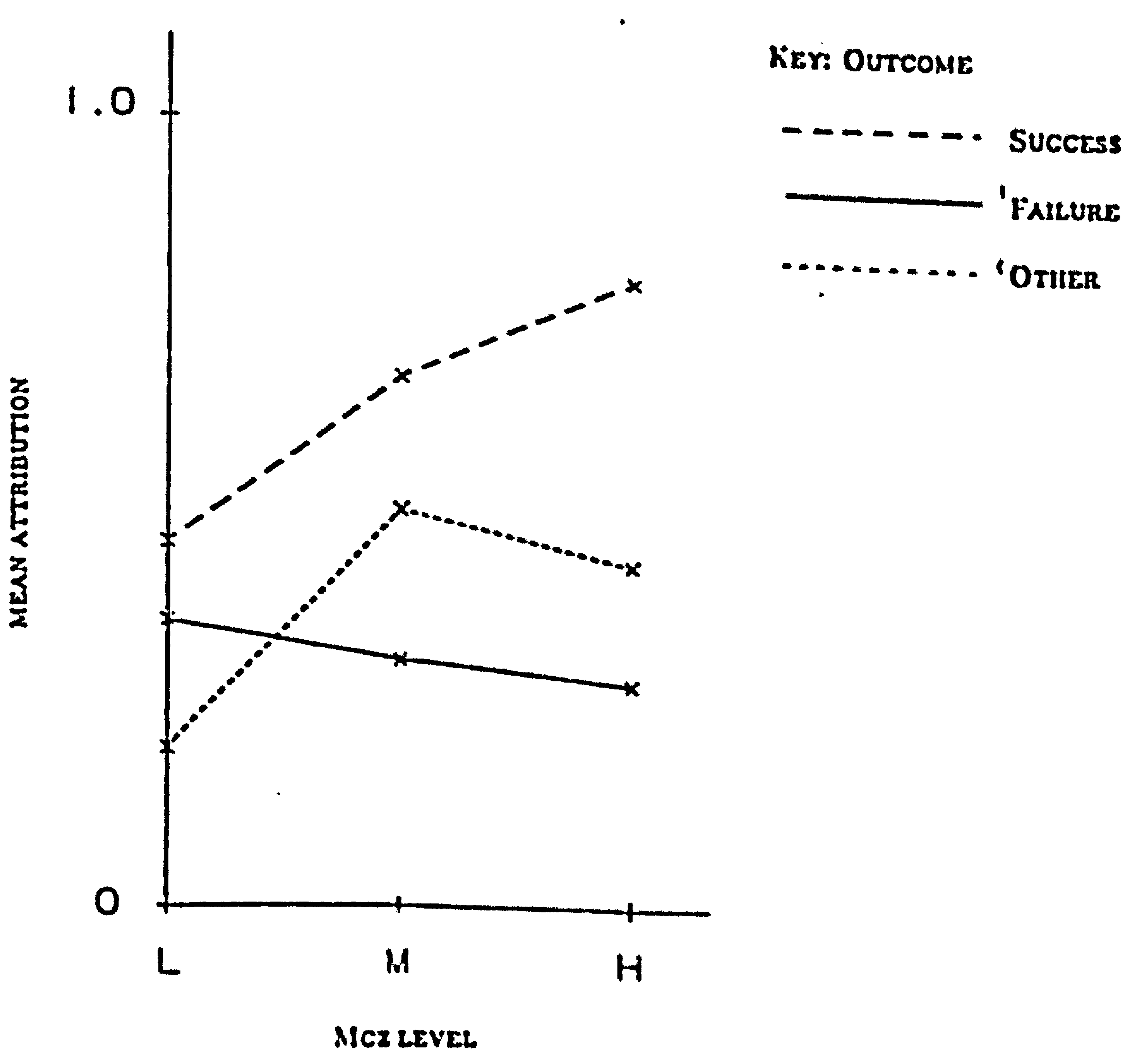
FIGURE 8: MEAN ATTRIBUTION BY STRATEGY-LEARNING WITH MCZ AND OUTCOME DEFINITION



The graph indicates that, whilst attribution to Strategy Learning increases with metacognitive level for those who define their own learning outcome, the same is not true for those who received an experimenter-defined outcome. In this group, attribution for Strategy Learning is reduced for the highest metacognitive level.

The results of the interaction of MCZ and outcome for the Effort Time Spent attribution type are presented in Figure 9.

FIGURE 9: MEAN ATTRIBUTION TO EFFORT-TIME SPENT WITH MCZ AND OUTCOME



The results indicate three distinct patterns of response for the three Learning Outcome groups. For those children whose learning outcome is a failure, attribution to Time Spent increases. That is, they see their failure as a result of not spending enough time. For those whose learning outcome was success, attribution to Time Spent decreases with metacognitive level. With increasing MCZ level, Time Spent is employed less to explain a successful learning outcome. For the "other" learning outcome, however, attribution to Time Spent is highest for the middle MCZ group.

Attribution Dimension

The analyses of variance of attribution dimension x MCZ x Processing x Outcome Definition x Outcome yielded five significant main effects and one higher order interaction.

A summary of the main effects is presented in Table (49).

TABLE (49): MEAN NUMBER OF ATTRIBUTIONS, F VALUES AND ASSOCIATED PROBABILITY OF F FOR THE ANALYSES OF VARIANCE OF INTERNAL, CONTROL, UNCONTROL, UNSTABLE AND SPECIFIC ATTRIBUTION DIMENSIONS WITH MCZ

		Internal	Control	Uncontrol	Unstable	Specific
Mean:	1	1.95	1.75	0.32	1.97	1.95
MCZ	2	2.60	2.32	0.56	2.64	2.80
	3	3.72	2.24	0.82	2.78	2.90
F df 2,108		5.91	3.11	3.80	5.56	7.01
p		<0.01	<0.05	<0.05	<0.01	<0.001

Cell means indicate that more Internal, Unstable, Uncontrollable and Specific attributions were made with higher metacognitive level. The significant effect for the Controllable attributions, however, derives from the difference between the low MCZ group and the two higher groups. Children in the middle and high metacognitive groups made more attributions, which signify perceived control, than than those in the low MCZ group.

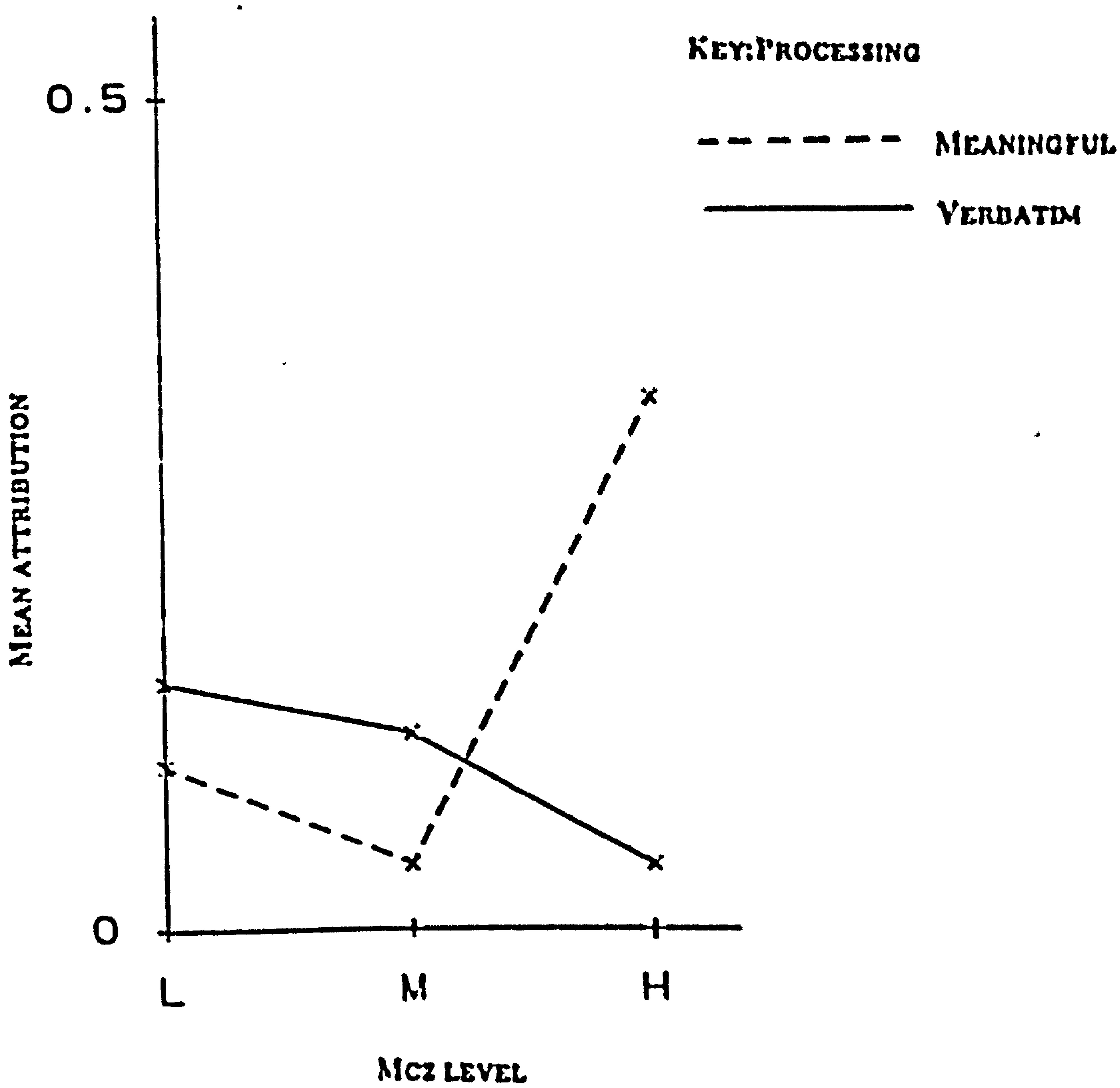
The results present a clear pattern of greater Internal, Unstable and Specific attributions being commensurate with higher levels of metacognition. Interestingly, both attributions which signify Control and Uncontrol also increase with high metacognitive level. This result suggests that more metacognitively advanced children are combining attributions and are attributing their learning outcome to both controllable and uncontrollable causes. Thus, they might, for example, attribute outcome to both the task difficulty (uncontrollable) and the efforts and strategy they used (controllable).

A higher order interaction emerged for the Global dimension. The results are reported in Table (50) and presented in Figure 10.

TABLE (50): SUMMARY OF HIGHER ORDER INTERACTION OF THE GLOBAL ATTRIBUTIONS WITH MCZ AND PROCESSING

Effect	F	df	P
MCZ	0.557	2,108	n.s
Processing	0.648	1,108	n.s
MCZ x Processing	4.13	2,108	<0.05

FIGURE 10: MEAN GLOBAL ATTRIBUTIONS WITH MCZ AND PROCESSING



The graph indicates that the interaction derives from the behaviour of children in the Meaning processing condition who are in the high MCZ group. These children make a significant increase in attribution to the global/general attribution types: General Ability, Luck and outcome relative to others.

In summary, the results of the analysis of variance of Attribution Type with MCZ and the experimental variables suggest these variables do interact, albeit in a complex manner. They confirm that metacognition has an effect in its own right on attribution. Analyses of variance of attribution dimension with MCZ and experimental conditions confirms this finding, indicating a clear relationship between the dimension of attribution and level of metacognition after the effects of age have been partialled out.

A comparison of the results of the analysis with MCA and that with MCZ indicates there is in fact a great deal of similarity, particularly in the analysis of attribution dimensions. The main effect of MCA for Specific Ability also emerged for the analysis by MCZ, where the effects of age were controlled. The main effects of metacognition with age (MCA) which emerged for attribution dimensions remained, even when the effects of age were removed. The results present a clear picture of metacognition affecting the dimension of attribution with an increase in the degree of internality, instability, specificity and both controllability and uncontrollability with increased metacognitive understanding.

6.4.5 A Check on the Effects of the Experimental Conditions

It is a possibility, however, that the relationship between metacognition and attribution obtained here has been affected by the experimental conditions. To examine this issue, correlations of both MCA and MCZ with attribution type and attribution dimension were calculated for each of the four experimental groups (derived from the 2 x 2 design) separately. In this way, control over treatment was achieved. The results are presented in Appendix 26.

MCA with Attribution Type

The results generally replicate those found in the analysis of the whole sample. In all groups, positive correlations between MCA and Strategy-Reading and MCA and Strategy-Learning were found. For both Verbatim processing groups, this relationship was significant ($p<0.001$). This result reflects the main effect for Strategy-Reading and the interaction effect of Strategy-Learning with processing previously discussed. Similarly, different correlation patterns for Knowledge and Effort-Concentration between groups reflects interaction effects previously reported. For the Specific Ability attribution type, however, the separate analysis does seem to indicate the effect of experimental conditions. Whilst a main effect for Specific Ability with MCA was reported, correlations indicate that for only three groups is there a positive and significant relationship. For the Meaning, Self-Defined group the relationship was negative but very low.

MCA with Attribution Dimension

Again, correlations largely reflected results previously reported. Positive correlations of MCA with Internal, Control, Uncontrol, Specific and Unstable attribution dimensions emerged for all groups which concurs with the main effects found. Whilst no higher order effects were found, correlations indicate that this pattern is more marked for those in the Verbatim processing group, for whom the majority of correlations were significant.

MCZ with Attribution Type

Correlations of MCZ with attribution type generally reflect results previously reported. All experimental groups evidenced positive relationships between attribution to Specific Ability and MCZ. This relationship is significant only for those in the Verbatim processing groups, however. Correlations reflect the previously reported interaction of experimental conditions with Strategy-Reading, Strategy-Learning and Effort-Time Spent.

MCZ with Attribution Dimension

Correlations of MCZ with attribution dimension suggest that experimental conditions are having an effect here. For the Meaning, External definition group, the relationship of MCZ with External, Controllable, Uncontrollable and Stable attribution dimensions was anomolous. For this group, in contrast to the positive relationship for the other groups, negative correlations emerged. The main effects reported for these attribution variables thus appear to be qualified by experimental conditions. Additionally, correlations indicate that whilst for Internal, Control and Unstable attribution dimensions the remaining three groups have positive correlations, only those in the Verbatim processing group attain a level of significance.

In summary, whilst some differences in the correlation matrices for each experimental group separately were found, the results largely reflect findings of the relationship between metacognition and attribution previously reported.

CHAPTER 7

SUMMARY AND DISCUSSION

The discussion of results presented in this chapter will address each of the research questions presented in Chapter 4. To assist the reader the aims of each stage of the study and a summary of the results pertaining to each question is presented at the commencement of each section.

7.1 THE NATURE OF METACOGNITION

7.1.1. Examination of Each Measure

As a preliminary investigation, data obtained from each of the four metacognitive measures was examined separately. It was of concern to establish whether developmental differences reported in the literature had been replicated and, in the case of Judging Task Difficulty (written by the author), to establish whether developmental differences were evident. Consistency of response (for repeated measures) and rank order (for non-repeated variables) was also examined. A high consistency of response across repeated measures would suggest the children had employed a "metacognitive principle" in making their responses. Further, both consistency of response and rank order of children indicate the relationship between measures and were to be the basis for selection of variables to be entered into the analysis of the relationship between measures. The aim was to identify and select distinct metacognitive variables as indices of metacognition.

Summary of Results

Generating Strategies

Development	(i)	a linear increase in the highest level strategy used with age.
	(ii)	no significant difference in the number of strategies generated with age.
	(iii)	a curvilinear pattern for the number of moves per strategy with nine year olds having the highest number of moves.
Consistency	(iv)	for the whole sample a consistency of rank order across tasks was found. This effect was not maintained in analyses for each age group separately where low consistency was found.

Organisation of Prose

Development	(v)	a linear trend with organisation of sentences (clustering), theme recognition and theme selection all increasing with age.
Consistency	(vi)	a high correlation between all three variables for nine and eleven year olds. A significant though weaker relationship between Theme Recognition and Theme Selection for the seven year olds.

Word List Generation

Development	(vii)	a linear increase in the use of principles of category and specific category in generating word lists for later recall, with age. A corresponding decrease in the use of phonic and graphic principles.

Judging Task Difficulty

Development	(viii)	No significant differences between age groups in the recognition and use of the principle of quantity.
	(ix)	Increase in the use of principles of relatedness and meaningfulness with age.
Consistency	(x)	High consistency of all repeated measures.

Discussion

For each measure, clear developmental trends were found. For qualitative variables these trends were largely linear and signified an increase in metacognitive knowledge and strategic behaviour. These findings were expected. They replicate findings previously reported (Kreutzer et al., 1975; Tenney, 1975; Danner, 1976) and, in the case of Judging Task Difficulty, concur with predictions made in the literature (Flavell and Wellman, 1977; Kreutzer, 1975).

For quantitative variables (derived from the Generating Strategies measure only), non-linear trends were evidenced. Whilst no age differences in the number of strategies generated was found, the data described a curvilinear trend in which the seven and eleven year olds employed a smaller number of moves per strategy than nine year olds. This finding was explained in terms of twin processes of increasing metacognitive knowledge and economy of presentation. It supports the proposals of writers such as Brown and DeLoache (1978) and Hagen et al. (1975) that metacognitive development is not so much the acquisition of new processes but more one of refinement of processes earlier acquired. It also draws attention to the important role of language in the study of metacognition. Metacognitive measurement is dependent on verbal report methods (Cavanaugh and Perlmutter, 1982; Sceneider, 1985). With language development the child is able to express metacognitive ideas more succinctly. The reduced number of moves per strategy evidenced in responses of the eleven year olds to Generating Strategies is explained not only by greater metacognitive sophistication (as, for example, the subsumption of "reading" into a more sophisticated and integrated "scanning" strategy) but also by the child's increased linguistic ability.

The finding of very high consistency across repeated measures for both Word List Generation and Judging Task Difficulty provides some indication of the internal reliability of the measures. It indicates that a given child responded in a similar way to each task and suggests they were employing a "principle of metacognition" in making their responses. This finding enabled the aggregation of repeated scores to reduce the number of variables for the examination of the relationship between each measure.

The low correlations across tasks (Generating Strategies) were not unexpected. This reflects the diverse nature of questionnaire items (task) used in this interview format measure. As a consequence of the finding, each task was retained as a separate variable for the between measure study. High consistency of rank order for Organisation of Prose, however, enabled the selection of representative variables for this second stage.

7.1.2 Relationship Between Variables

An examination of the relationship between metacognitive measures was conducted to establish the nature of metacognition. Specifically, it was of concern to establish whether metacognition, as it was measured here, represented a general process (as, for example, that suggested by Brown, 1975; Hagen et al., 1975 and Brown and DeLoache, 1978) or whether it was specific to the tasks from which it was derived.

If metacognition is a general process we would expect a strong relationship between measures. In contrast, if metacognition is specific a weak relationship between measures would be expected. In the present study, factor analytic methods were used to investigate the relationship between metacognitive measures. Variables selected to represent each individual metacognitive measure were factor analysed using Principal Axis Factoring. Given these conditions a strong relationship would be indicated if factors comprised variables from each of the individual measures. A weak relationship would be indicated, however, if factors corresponded more closely to the measures from which they are derived. Analyses were conducted for the whole sample and for each age group separately.

Summary of Results

(i) Factor Analysis for the whole sample yielded three factors with an eigen value greater than or equal to one.

Factor 1 corresponded directly to Word List Generation.

Factor 2 comprised qualitative variables from Generating Strategies and Judging Task Difficulty.

Factor 3 comprised all quantitative variables from Generating Strategies.

A fourth factor which failed to reach an eigen value of one corresponded directly to Organisation of Prose.

(ii) There was considerable overlap between results of the analysis for the total sample and those for each age group separately. The three factor matrices for analysis by each age group separately, though not identical, yielded four factors which were also found in the whole sample analysis.

Discussion

The result suggests that metacognition is not a unitary construct but rather specific to the task from which it is derived. Whilst common features were evident in the four measures of metacognition employed in the study (they were for example all concerned with strategic behaviour), the relationship was not sufficient to indicate the general metacognitive process suggested in the literature (Brown, 1975; Hagen et al., 1975; Brown and DeLoache, 1978). Only one factor (Factor Two) comprised variables from more than one of the original measures.

The result reflects the problems of definition and measurement of metacognition discussed in Chapter 1 (Section 1.3) and indicated in recent reviews of literature (Cavanaugh and Perlmutter, 1982; Schneider; 1985). Three of the four measures employed in the present study were derived from existing metacognitive literature. They were selected as representative of "central instances" (Wellman, 1983) of metacognition documented in the literature which were relevant to the age group of the study (see Section 5.1.1). For each measure, however, the type of measurement and the implicit definition of metacognition varied. For Generating Strategies, for example, metacognition was measured and implicitly defined in terms of both productivity (number of strategies) and maximum performance (highest scoring strategy). In contrast, identification and grouping processes measured metacognition in Organisation of Prose whilst, for Word List Generation, use of organisational principle served the same function. In short, very specific tasks and processes were used to measure what has been conceptualised as a general concept - metacognition.

The criteria for selection of variables to represent each measure may have further accentuated the finding of disunity of metacognitive measures. Correlations of variables within each measure were calculated from which those variables which were most distinct (low correlations) were selected for factor analysis. The rationale for this procedure was that a range of metacognitive phenomena was being identified. It may be, however, that this procedure in fact removed a common metacognitive effect within each measure.

The results point to the need for further investigation of the measurement of metacognition and of the relationship between measures. Firstly, as Robinson (1983) indicates

> *There has been very little experimental work on the development of metacognitive knowledge which can be applied to a wide range of problems.* (page 117)

It may be that if the nature of metacognitive measurement changed (such that it assessed general knowledge or processes) empirical relationships between measures would be stronger than those found here. Flavell and Wellman (1977) make a similar suggestion in their call for measures of metacognition which require integration (rather than just expression) of metacognitive knowledge. Judging Task Difficulty, the measure written by the author for the present study, was one attempt to provide such a measure. Interestingly, it was the only measure to load substantially on a metacognitive factor following factor analysis. Secondly, more extensive work of the nature of this preliminary investigation may provide a different picture of the "nature" of metacognition. The relationship between only four measures of metacognition was examined in the present study. Correlation and factor analytic techniques could be used to examine the relationship between a larger number of measures. Further, the measures studied in the present study relate to one age range. It may be that the relationship between measures changes with age and situation. Reliability of both the metacognitive measures themselves and of their relationship requires further investigation. Reliability has not been addressed in the present study.

7.1.3 Indexing Metacognition

The selection of variables most representative of metacognitive development is at present difficult to accomplish. There is a need to further investigate the nature of metacognition before reliable indices can be established. The selection of variables to index metacognition in the present study, however, was based on the findings of a "disunified" notion of metacognition. The two variables with the highest loading on each of the four metacognitive factors yielded by the factor analyses were included in the initial investigation of the relationship between metacognition and attribution for learning outcome.

7.2 ATTRIBUTION TYPE AND ATTRIBUTION DIMENSION

7.2.1 The Range of Attribution Type Employed by Children Aged Seven to Eleven Years.

The majority of studies of children's attributions for learning outcome have, following Weiner (1972, 1979, 1980), used closed methods to elicit attributions. Such closed methods entail the presentation of only four categories of attribute (Ability, Effort, Luck and Task) from which the child makes a forced choice. A very much smaller number of studies have employed open methods to elicit attributions. These entail a procedure in which the child is presented with an open question such as "Why did you succeed / fail?" following which the child is free to explain learning outcome in his own terms. Many of these open method studies are based on hypothetical rather than directly experienced situations. They present evidence for observer rather than participant attributions (see Jones and Nisbett, 1972; Brown, 1986). It was thus of initial concern here to establish the range of attribution types used by children in the present study where an open method was employed to elicit attributions following learning outcome on a directly experienced learning situation (attributor = actor). A dimensional analysis of attribution types was also undertaken.

Summary of Results

(i) Sixteen attribution types were identified in the children's responses: Strategy-Reading, Strategy-Learning, Strategy-Recall, Effort-Concentration, Effort-Time Spent, Interest, Knowledge, Specific Ability, General Ability, Outcome-Normative, Task Difficulty-Passage, Task Difficulty-Test, Mood, Circumstance, Guessing, Luck.

(ii) Of the sixteen attribution types, nine were retained for further statistical analysis using a criterion of frequency. Each represented at least 3% of the total responses.

(iii) Four attribution types accounted for 73% of the total responses. These were two classes of Effort (Concentration and Time Spent) and two classes of Strategy (Reading and Learning).

(iv) Dimensional analysis of attributions indicated that the majority of responses were Internal, Specific, Controllable and Unstable.

Discussion

The results obtained in the present study replicate those of previous research which has employed open methods to elicit attributions (Little, 1985; Bar Tal and Darom,

1979) That is, they indicate that children's attribution for learning outcome extends beyond the four classes of attribute suggested by Weiner (1979) and utilised by studies which employ closed methods. They also concur with research findings that children in the primary school age range use attributions which are specific to situation in explaining learning outcome (Nicholls, 1983; Little, 1985).

A notable difference in the findings of the present study from those of the general body of attribution literature is that of the low frequency of use of Ability attributions to explain learning outcome. Whilst two categories of ability attributions (Specific Ability and General Ability) were found in the data, Ability was not a major focus of explanations given. Together the two Ability attribution types accounted for only 5% of the total response (Specific Ability 3% and General Ability 2%). The frequency of use of the General Ability was not sufficient to allow further statistical analysis. This finding is contrary to consistent reports in the literature that Effort and Ability are major explanations of learning outcome used by children (Weiner, 1979, 1983; Brown, 1986; Rholes et al. 1980; Ruble and Boggiano, 1980).

One very apparent reason for this finding is the use of open methods to elicit attributions in the present study. In contrast, the majority of attribution studies use closed methods in which children are given a forced choice between a very limited number of attributes. Closed methods present Ability and Effort as "likely candidates" to explain outcome. The suggestive nature of closed methods and the less abstract nature of Effort and Ability compared with Task and Luck (these are both more removed from the child as external attributes, *cf.* Shultz and Butkowsky, 1977) favourably loads the chance of their selection. Further, by limiting the number of attribution types the child has to explain learning outcome, a categorical response rather than specific response is enforced. Thus, an Ability attribution within a closed method may serve as a category for attribution types such as Strategy and Knowledge dependent on the child's interpretation of the category Ability (see Weiner, 1983 for further discussion of this issue).

The use of an open method to elicit attributions does not alone account for the low frequency of ability attributions found, however. Other studies which have employed open methods have not found the same (Freize and Snyder, 1980; Little, 1985; Cauley and Murray, 1982). The result is also the product of direct participant methods used in the present study. Here children made attributions as actors. Their attributions were for a genuine learning outcome following an actual learning experience. In contrast, many studies discussed have relied on hypothetical methods (Little, 1985; Frieze and Snyder, 1980) or asked for attributions for others rather than self (Little, 1985). Research documents the biasing effect of actor versus observer positions on attributions. In circumstances where attribution is made from the position of observer, more general attributions such as General Ability are more likely (Jones and Nisbett, 1972).

One study with a method perhaps comparable to that of the present study is provided by Cauley and Murray (1982). They elicited attributions using open methods following a direct learning experience. The results of this study, unlike those of the present, indicated that children did use Ability attributions. However, Cauley and Murray (1982), included direct questions concerned with ability as prompts in addition to open ended questions. Whether the Cauley and Murray study is in fact "open" is thus questionable. Additionally, children were asked to make comparisons with performances of other children. This may have directed children toward an "ego-involved" rather than "task-involved" focus and thus made ability more salient an attribute in explaining learning outcome (Nicholls, 1983; Nicholls and Miller, 1984a, 1984b). It would seem that in the present study children were task-involved and ability was not a salient attribute in explanation of learning outcome.

This claim is supported by the results of dimensional analysis which indicate that attributions were largely Internal, Controllable, Unstable and Specific.

7.2.2 USE OF ATTRIBUTION TYPE AND DIMENSION WITH AGE

One proposal of the present study, and indeed a common finding reported in the literature, is that of an age-related bias in the type of attribution used to explain learning outcome and subsequent age-related differences in attribution dimension. It is proposed in the present study that this difference is explained, in part, by underlying developing metacognition. Before examining the relationship between metacognition and attribution it was necessary to establish if such age-related biases were present in the data and, if so, to ascertain their nature. To this end analyses of variance of attribution type and dimension by age were conducted.

Summary of Results

(i) Significant age effects emerged for three attribution types: Strategy-Reading, Strategy-Learning, and Knowledge. The use of all three increased with age.

(ii) Significant age effects emerged for four-dimensional poles of attribution. With age, attributions were more Internal, Controllable, Specific and Unstable

Discussion

The results confirm the predicted age-related biases. The attribution types for which significances emerged are of particular interest. They relate to Strategy and

Knowledge attributes of the learning situation; both of which are clearly metacognitive attributes.

The significant age effects for attribution dimension were also predicted. It was suggested that with age the child acquires greater metacognitive knowledge and control over learning and takes greater personal responsibility for learning. The finding of greater control and internality lends support to this claim. In the light of the evident "task focus" reflected in the frequencies of attribution type, we would expect the increase in specificity and unstable dimensions found here. Metacognitive research indicates that with age the child has a larger repertoire of strategies and can distinguish more specifically between tasks in his application of these.

7.2.3 The Effects of Learning Outcome on Attribution

A common finding reported in attribution literature is that attributions are biased by the learning outcome (success or failure). Typically "ego enhancing" biases are reported in which success is attributed to self (internal) and failure to external attributes. Whilst the effect of learning outcome was not included in the research questions addressed in the study, the effect of learning outcome was examined as check procedure. The effect of Outcome on attribution was examined in analyses of variance of attribution type and attribution dimension.

Summary of Results

(i) One main effect of Outcome emerged for attribution type. This was for Effort-Time spent. Those children whose learning outcome was failure made significantly higher attributions to Time Spent than those whose outcome was either success or other.

(ii) One Age x Outcome interaction effect emerged. This was for Effort-Concentration.

(iii) No Outcome effects for attribution dimension.

Discussion

Outcome had surprisingly little effect on children's explanations for learning. This result is explained by both the method of eliciting attributions employed in the present study and the apparent "task focus" of the children responding. Firstly, the open method used allowed children a wider range of response than does the closed method. Whilst children in the present study were free to express exactly their explanations for learning outcome, children explaining learning outcome within a closed method are limited in their expression to a forced choice between four categories of attribute. Of these, Ability and Effort are prominent. The range of attribution types presented by the open method used here compared with the focus on Effort and Ability in closed methods is likely to have reduced the effect of Outcome. Secondly, results indicating the range of attributions used by children in the present study suggest the children were task focussed. The majority of attributions were for Effort and Strategy. Studies such as those of Diener and Dweck (1978, 1980) and Cullen and Carver (1982) suggest that when the child is task focussed learning outcome has less impact on the child. Failure, for example, does not result in negative effects and the focus of learning remains on Strategy and Effort.

7.3 THE RELATIONSHIP OF METACOGNITION AND ATTRIBUTION

The present study hypothesised two possible relationships between metacognition and attribution for learning outcome. The first was a developmental hypothesis: that attribution is an expression of underlying developing metacognitive knowledge. The second was a causal hypothesis: that metacognition directs attribution for learning outcome both by affecting the definition of learning outcome and by structuring the salience of causal attributes.

A first stage in investigation of these proposals was to establish the strength of the relationship between measures of metacognition and attribution for learning outcome using correlation procedures. In the case of both hypotheses a strong relationship was predicted.

Summary of Results

(i) correlation between the eight metacognitive indices and attribution type for each age group separately indicated a generally weak relationship. A count of significant correlations indicated that only 19% of the total correlation for seven year olds and 15% for both nine and eleven year olds were significant.

(ii) a meta-analysis of the three separate age correlation matrices of metacognitive indices and attribution type indicated that only 15% of correlations were significant.

(iii) Correlation between the eight metacognitive indices and attribution dimensions again indicated a weak relationship. A count of significant correlations for each age group separately indicated that 28% for seven year olds and 8% for both nine and eleven year olds were significant.

(iv) a meta-analysis of the three separate age correlation matrices of metacognitive indices and attribution dimension found that 25% of correlations were significant.

(v) It was found that three indices of metacognition were the best predictors of attribution: OS, GSAM, RAT2. These accounted for 64% of significant correlations with attribution type and 73% of significant correlations with attribution dimension.

Discussion

The results suggest a generally weak relationship between metacognition, as it has been measured in the present study, and attribution for learning outcome. The predicted strong relationship between metacognitive indices and attribution was not found.

Two interpretations of this finding are apparent. The first related to the nature of the relationship itself. It may be that metacognition and attribution are indeed only very weakly related concepts. The only link between them may be that they are both cognitive phenomena. This is an unlikely explanation, however. The literature documents clear theoretical and conceptual links between the two (Miller, 1985; Flavell, 1981a, 1981b). Further, an empirical relationship between the two is suggested (Clifford 1986a, 1986b; Cullen, 1985; Cullen and Carver, 1982). The second interpretation focusses on the measurement of metacognition. It may be that the measures of metacognition employed in the present study do not sufficiently represent the central notion of metacognition discussed in the literature (e.g. Brown, 1975).

The three measures of metacognition for which a stronger relationship was found may more closely approximate this central notion. In further analyses of the relationship between metacognition, therefore, only these measures were retained. Two new metacognitive variables were created by aggregating the three metacognitive indices. For the first variable, age biases were incorporated in the variable: MCA. For the second variable, age was partialled out using standardising procedures (z scores) to create a pure metacognitive variable: MCZ.

7.4 THE DEVELOPMENTAL HYPOTHESIS

Analyses of variance techniques were used to examine the effects of metacognition (MCA and MCZ) and learning conditions (Outcome Definition and Processing) on attribution type and attribution dimension. Effects of Outcome (success, failure, other) were also examined. If the developmental hypothesis is true, we would expect to find effects for MCA (metacognition with age) but not for MCZ (metacognition with developmental effects removed), Processing or Outcome Definition.

Summary of Results

(i) Main effects emerged for MCA with three attribution types: Strategy-Reading, Strategy-Learning and Specific Ability. In each case the use of Attribution type increased with MCA.

(ii) Interaction effects emerged for three attribution types:
Strategy-Learning x MCA x Outcome
Effort-Concentration x MCA x Processing
Knowledge x Processing x Outcome.

(iii) Main effects emerged for MCA with five poles of attribution dimension: Internal, Specific, Unstable, Control and Uncontrol. In each case the mean increased with MCA.

(iv) An interaction effect for Unstable x MCA emerged.

(v) A main effect emerged for Specific Ability with MCZ. The use of Specific Ability to explain learning outcome increased with MCZ.

(vi) Interactions emerged for three attribution types with MCZ:
Strategy-Reading x MCZ x Processing x Outcome Definition
Strategy-Learning x MCZ x Outcome Definition
Effort-Time Spent x MCZ x Outcome.

(vii) Main Effects of MCZ emerged for five poles of attribution dimension: Internal, Control, Uncontrol, Unstable, and Specific.

(viii) An interaction effect for one pole of attribution dimension emerged: Global x MCZ x Processing.

(ix) No main effects for Outcome emerged.

Discussion

The finding of main effects of MCA on both attribution type and attribution dimension provides support for the developmental hypothesis.

The results for the analysis of attribution type indicate that with increased MCA, attribution to Strategy-Reading, Strategy-Learning and Specific Ability also increased. These are expected results. Metacognitive research documents that with age the child's knowledge of strategies increases. This increased knowledge is expressed in attributions for learning outcome.

The results of the analysis for attribution dimension indicate that with increased MCA attributions became more Internal, Controllable, Specific and Unstable. They also became more Uncontrollable. Of these five significant effects, four are expected: they would be predicted by the metacognitive literature. The greater Internal and Controllable attributions reflect the greater control and responsibility for learning which derives from the acquisition of metacognitive knowledge and strategies with age. The increased Specificity of attributions is an expression of the documented refinement of strategies that occurs with age (Brown and DeLoache, 1978; Hagen et al., 1975; Brown, 1975) whilst the increase in Unstable attributions reflect the emphasis on strategy and specific abilities. The finding of an increase in Uncontrollable attributions with MCA was not predicted. It suggests that with increased metacognition and age the child not only perceives greater personal responsibility and control over learning but also recognises there are variables in the learning situation which are outside his control. It perhaps signifies the emergence of greater "realism" that develops with age and metacognitive development (Harter, 1981; Harter and Connel, 1984; Nichols, 1983).

The finding of both main effects for MCZ and interaction effects with learning condition factors weakens the developmental hypothesis, however. The main effect for MCZ suggests that metacognitive differences occur within age groups and are not just a developmental factor. It may suggest differential development within age group. More importantly, the interactions with learning conditions lend support to the causal hypothesis which suggests the effect of metacognition is that of structuring attributes of the learning context. Interaction effects are discussed further in Section 7.5 below.

7.5 THE CAUSAL HYPOTHESIS: (A) THE EFFECTS OF LEARNING OUTCOME

The first proposal of a causal relationship between metacognition and attribution was that metacognition affects the definition of learning outcome. Research documents that with age the child generates his own definition of learning outcome based on individual standards (Frieze, Francis and Hanusa, 1983; Harter, 1981). It has been suggested in the present study that with metacognition the child is more able to distinguish between tasks and identify those salient aspects of a task which define its successful completion or otherwise.

7.5.1 THE RANGE OF SELF-DEFINED LEARNING OUTCOMES.

An initial point of interest was the range of learning outcome definitions given by children using self-imposed criteria. In attribution research outcome definition is generally presented by an external source. Further, learning outcome is generally dichotomised into "success" and "failure" categories. It was of interest to find if children employed such a dichotomy when allowed to define their own learning outcome.

Summary of Results

(i) the majority of children (89%) defined their learning outcome as "success" or "failure". A small proportion (11%) defined their learning outcome as being at a midpoint between these. They defined their outcome as "*average*" or "*okay*".

(ii) The scores used to define success and failure varied subjectively but, with age, more closely approximated normative scores. Scores used to define an outcome which was neither a success nor a failure approximated the mean score for age.

Discussion

Although the majority of children defined their learning outcome within the success / failure dichotomy the finding that 11% of children did not fall into this category is an important result. It calls into question the assumption made by attribution research that learning outcome is a dichotomy of success and failure. It suggests that learning outcome is rather viewed as a continuum by some children. This response was found despite the clear achievement orientation of the present study. It may be that, in a classroom where the surrounding conditions are less immediately achievement orientated, a larger proportion of children view their learning outcomes as at a midpoint between success and failure.

The range of scores used to designate a success and failure suggest that children were employing individual standards in defining their outcomes. A score as low as 3 was defined as success and one as high as 8 was defined as failure. This finding concurs with reports in the literature that suggest the use of individual standards in defining learning outcome (Crandell, 1963; Frieze, Francis and Hanusa, 1983; Ruble and Boggiano, 1981). The trend toward a definition which approximates that of the normative with age may reflect a learned "normative" standard. The child may have learned that, for example, 5/10 is an "average" score.

7.5.2. Attribution Type, Attribution Dimension and Learning Outcome Definition

If self-defined learning outcomes differ from those given by external sources (teachers, experimenters) we would expect to find differences in the attributions used to explain them. It is the proposal of the present study that the criteria used to define learning outcome will also be used to explain learning outcome and thus attribution would differ.

In the present study, this proposal was examined by comparing the attribution responses of children for whom learning outcome was externally defined with those of the children who defined their own learning outcome. Outcome Definition (two levels: self-defined versus external) was entered as a factor in an analysis of variance of both Attribution Type and Attribution Dimension.

Summary of Results

(i) No significant effects of Outcome Definition emerged for either attribution type or attribution dimension.

Discussion

The result clearly indicates that outcome definition alone does not influence attribution for learning outcome. It suggests that the criteria used to define and explain learning outcome was the same for both self- and experimenter-defined groups. That is, the same learning outcome (success, failure, "other") has the same meaning regardless of who defines it.

7.5.3 THE EFFECT OF METACOGNITIVE LEVEL ON ATTRIBUTION TYPE AND ATTRIBUTION DIMENSION FOR SELF VERSUS EXTERNAL LEARNING OUTCOME DEFINITION

Although Outcome Definition alone had not been found to influence attribution for learning outcome, the possibility that it had an effect in interaction with other factors remained. It was of particular interest to see if Outcome Definition interacted with metacognition and processing. An interaction with MCZ or Processing would strengthen the hypothesis, however, indicating that outcome definition related to the particular task type.

Summary of Results

(i) No interaction between MCA, Outcome Definition and Attribution Type was found.

(ii) No interaction between MCA, Outcome Definition and Attribution Dimension was found.

(iii) Two interactions between MCZ, outcome Definition and Attribution Type emerged:
Strategy-Reading x MCZ x Processing x Outcome Definition;
Strategy-Learning x MCZ x Outcome Definition.

(iv) No interaction between MCZ and Attribution Dimension was found.

Discussion

Whilst no interaction effect of Outcome Definition with metacognition emerged when metacognition incorporated developmental bias (MCA), two effects emerged when developmental effects were partialled out (MCZ). This suggests the effect of outcome definition is relative to metacognitive functioning only. It occurs within metacognitive groups but not across age groups.

The two way interaction effect of MCZ x Outcome Definition on Strategy-Learning, indicates the use of this attribution type increased with MCZ when Learning Outcome is self-defined but decreases with MCZ when learning outcome is externally-defined. This is not a surprising result. It suggests the focus for children who define their own learning outcome is their immediate actions (learning strategy).

In contrast, the focus of children for whom learning outcome is defined may not only be on their own actions but on interpreting the criteria used by the external source. The three way interaction effect of MCZ x Processing x Outcome Definition is complex. One general discernible trend is that the effect of outcome definition is mainly on the responses of those in the Meaningful processing group. Again this is not a surprising result. The range of possible attributes on which definition of learning outcome could be based is wider for the open Meaningful learning condition than for the closed Verbatim learning condition. It is thus more likely that the effect will be on the Meaningful condition. The result, however, indicates a curvilinear relationship with the middle metacognitive group responding differently to low and high groups. The reason for this is not clear.

7.6 CAUSAL HYPOTHESIS: (B) EFFECTS OF PROCESSING

The second proposal of a causal relationship between metacognition and attribution was that metacognition affects the child's ability both to distinguish between tasks (identify salient attributes) and to adapt strategies to task. It was proposed that the child's increasing awareness of the subtle differences between tasks and subsequent adaptation of strategy would be reflected in attribution for learning outcome.

7.6.1 THE EFFECT OF PROCESSING ORIENTATION ON ATTRIBUTION TYPE

In the present study this hypothesis was tested by comparing attribution for learning outcome following meaningful deep processed task orientation and those following Verbatim, superficial processing task orientation. It was suggested on the basis of findings of cognitive studies that success on the Verbatim task would be dependent on the child's capacity and Strategies of rehearsal. In contrast, success for the meaningful task would be dependent on prior knowledge and strategies of selective reading and elaboration (Ausubel, 1968; Spiro, 1982; Baddeley, 1976; Wessells, 1982). It was thus hypothesised that, whilst children in the Verbatim condition would make attribution to Specific Ability, children in the Meaningful condition would make significantly more attributions to Knowledge. No difference in Strategy attribution was predicted because the categories attribution type did not distinguish the type of strategy. Thus, a rehearsal strategy and elaboration would both be Strategy-Learning attribution type.

Summary of Results

(i) Two significant main effects of Processing on attribution type emerged. These were for Knowledge and Specific Ability attribution types. The mean attribution to Knowledge was significantly higher for those in the Meaning processing group whilst mean attribution to Specific Ability was higher for those in the Verbatim Processing group.

Discussion

The results were as predicted. They reflect the hypothesised effects of task on the salience of causal attributes. The result confirms Wigfield's (1988) prediction that main effect for processing orientation would be found if the problems of evaluation biases experienced in his study were removed (see Chapter 2, Section 2.4.4). The method employed in the present study did not remove evaluation but rather provided an evaluation that enhanced different orientations (*cf.* Butler, 1988).

7.6.2 The Effect of Processing Orientation on Attribution Dimension

It was of interest to examine the effects of processing on attribution dimension also. Whilst no specific hypotheses were postulated, the assumption of a concurrent change in attribution underlies the hypothesised effect of processing on attribution type. Processing was thus entered as a factor in an analysis of variance of attribution dimension.

Summary of Results

(i) Significant processing effects emerged on four poles of attribution dimension: Internal, Specific, Unstable and Control. In each case the mean for the Verbatim processing group exceeded that of the Meaningful processing group.

Discussion

In each case the results indicate a clear effect of processing on attribution dimension with the Verbatim processing condition attaining the highest mean.

The result can be explained by the differing structure provided by the two processing conditions. The meaningful processing condition has an open structure. The definition of learning outcome for such a task is "understanding" which is a qualitative, subjective criterion. Moreover, the range of appropriate strategies to achieve this end is broad. In contrast, the definition of success for Verbatim processing is "remembering" which is a quantitative and objective criterion defined largely by the task itself. The range of appropriate strategies is limited to rehearsal.

The closed and definite structure of Verbatim processing appears to have been more manageable for the children in the age range studied than Meaningful processing. This is indicated by the greater Internal and Control attributions. The wider range of strategy and the ability to accept an open definition of learning outcome demanded by Meaningful processing may not be manageable for children in the age range studied. Certainly developmental studies document younger children's need for closure (Collis, 1978).

The closed nature of the Verbatim task compared with the open nature of the Meaning task may also account for the difference in specificity stability of responses with processing. Given the more limited range and lower level strategies appropriate for Verbatim processing compared with Meaning processing, the child is able to be more specific. Further, whilst the Verbatim task requires Effort and rehearsal strategies, the Meaning task requires not only effort and strategy but also is concerned with stable qualities of the task itself (content).

An effect of task structure such as that discussed here has been previously reported (Thorpe, 1985).

7.6.3 EFFECT OF LEVEL OF METACOGNITION FUNCTIONING ON ATTRIBUTION TYPE FOLLOWING DIFFERENT PROCESSING

Having established a relationship between processing orientation and attribution for learning outcome, a final stage in the analysis was to examine whether the effect could be explained by metacognitive functioning. To this end, two analyses of variance of attribution type in which both metacognition and processing were factors were conducted. In the first, analysis the metacognitive factor MCA incorporated age bias whilst, in the second, MCZ which has the effects of age removed was the metacognitive factor. An interaction effect of metacognition (MCA and MCZ) x processing would support the causal hypothesis that with metacognition children are more aware of processing differences and distinguish them in explaining learning outcome. An interaction of MCZ with processing, additionally, would indicate that the effect was due to metacognition alone and not a developmental function.

Summary of Results

(i) Two MCA x Processing effects emerged for attribution type. These were:

Effort Concentration x MCA x Processing

Knowledge x MCA x Processing x Outcome.

(ii) One MCZ x Processing effect emerged for attribution type: Strategy-Reading x MCZ x Processing x Outcome Definition.

The interaction effects found lend support to the proposed relationship between metacognition, processing and attribution for learning outcome. In each, however, the interactions are complex and the exact nature of the relationship is not clear. Further, the number of interactions found is small. We might have expected to find a greater number and more distinct patterns of interaction. In particular, interactions with Knowledge and Specific Ability for which main effects of processing were found would be predicted. Interaction effects only emerged for Knowledge attributions, however.

The explanation for the findings may again lie with the problems of measurement of metacognition encountered throughout the study. Thus whilst there is indication of a relationship between metacognition and attribution via processing, a stronger and more distinct relationship may have emerged given indices more central to the notion of metacognition and hence of higher construct validity.

7.6.4 The Effect of Level of Metacognitive Functioning on Attribution Dimension with Processing

The effect of processing orientation on attribution was clearly indicated by the finding of main effects for Processing. Again, it was of concern to establish whether this effect could be explained by level of metacognitive functioning. Two analyses of variance of attribution dimension with metacognition and Processing as factors were conducted. As with the analysis of attribution type, the first employed MCA, which incorporated developmental bias, as the metacognitive factor whilst the second employed MCZ which had the effects of development removed. Again, an interaction between metacognition and processing would support the causal hypothesis that metacognition affects attribution via processing. This case would be particularly strong if effects for MCZ were found.

Summary of Results

(i) One interaction effect of MCA x Processing emerged. This was for the Unstable attributions. The result indicated that those children in the high MCA group in the Verbatim condition made significantly more unstable attributions than those in the Meaningful processing group.

(ii) One interaction effect of MCZ x Processing emerged. This was for Global attributions. Children in the high MCZ group who had undertaken the Meaning processing orientation made significantly more global attributions.

Discussion

In the examination of main effects of Processing on attribution type, significant effects emerged for four dimensional poles. If this effect is due to metacognitive functioning, we would expect a metacognition x processing effect for the same poles. This was not the case. Only one such interaction emerged. Additionally, an MCZ x processing effect emerged for another dimensional pole, Global. The result is again likely to reflect the problems of the metacognitive indices employed in the study.

The finding of increased Unstable attributions with MCA must be explained in the light of the apparent task focus of children in the study. Attribution literature reports that with age the child develops a more general concept of his own ability which is reflected in increased attributions to Ability and a subsequent increase in Stable attributions. However, in the present study where open-ended methods allowed a freer expression of attribution and where the child's focus of explanation for learning outcome was on the task, this effect was not found. Instead, attributions to Effort and Strategy were prominent. Findings in the field of metacognition indicate that with age the child has a greater repertoire of strategies and hence a greater control over his own learning. This would suggest an increased emphasis on Strategy. As the number of attributions each child could make was not restricted in the study, the increased number of attributions in the unstable dimensional pole is most probably a function of the increased number of strategy attributions.

The finding of an effect of MCZ x Processing on Global dimensional pole indicates that within each age level as metacognitive functioning increases so does the use of general attribution types (General Ability, Luck). The result reflects the greater integration of knowledge reported to occur with increased metacognitive functioning (Hagen et al., 1975). Though this finding would appear to be inconsistent with the previously reported finding that children's attributions become more specific and unstable with age, it is not in fact the case. Firstly, the effect is with MCZ which examines effect within age group. Secondly, as the number of attributions per child was not restricted this result indicates that the children in the highest metacognitive group are using both general and specific, unstable attributions.

7.7 GENERAL DISCUSSION

The difficulty of defining and measuring metacognition has emerged as a central issue in the present study. Though the selection of measures was based on a justifiable rationale (existing literature of "central instances of metacognition" relevant to the age group to be studied) and a thorough investigation of measures both in pilot studies and statistical examination was made, problems with the measures were encountered. The studies from which the measures were drawn were initiating studies and the notion of metacognition an heuristic. The measurement of the concept was based on very specific tasks. The relationship between metacognitive measures was weak suggesting that metacognition, as it was measured here, was not a unitary concept.

The relationship between metacognition and attribution, whilst theoretically and conceptually established in the literature, was not upheld by the empirical investigation. The explanation for this finding again appears to be associated with the problems of measurement of metacognition. The measures used to index metacognition empirically did not appear to tap the general notion of metacognition discussed in the literature.

Using those measures which best predicted attribution, however, the hypothesised relationships between metacognition and attribution were examined. If the developmental hypotheses were true, a main effect for metacognition with age

(MCA) was predicted. If the causal hypothesis was true a main effect for metacognition with age effects removed (MCZ) and interaction effects of metacognition (MCA and MCZ) x learning conditions (Processing and Outcome Definition) were predicted. Partial support for both hypotheses was obtained. Main effects for MCA with three attribution types and four dimensional poles were found indicating a relationship between development, metacognition and age. However, main effects of MCZ were also found for one attribution type and the same dimensional poles. Additionally, whilst little effect of outcome definition on attribution was evidenced, the processing was found to affect attribution and to interact in some case with metacognition to affect attribution type and dimension. The results suggests that metacognition has an effect on attribution both within and across age groups. The present result must be viewed in the light of the problems of indexing metacognition but it may be that with more unified indices of metacognition a stronger effect would be found.

The study points to the need for further investigation of the concept of metacognition and its measurement. It echoes the calls made in recent reviews of the metacognition literature (Brown et al, 1983; Robinson, 1983; Schneider, 1985).

One notable finding of the study is that of the effect of Processing on attribution for learning outcome. Clear effects of Processing on attribution were found. The results indicated that Verbatim processing resulted in "more healthy" internal, unstable, controllable and specific attributions than Meaningful processing. The result is explained by the closed structure of the Verbatim task compared with the open structure of the Meaningful task. It suggests that Verbatim tasks are more motivating to children of the age studied here.

The study also indicates the effect of research method on the results of attribution studies. The results obtained in the present study which employed open methods to elicit attributions were notably different from those reported in the literature which typically employs closed methods. Further, the results obtained in the present study in which children made attributions following a direct learning experience and where the outcome attained was genuine, produced different results from those reported in the large body of attribution literature which employs Hypothetical-indirect methods or which manipulate learning outcome. The choice of direct methods is particularly important in the light of the general finding that the position of actor and observer differ in making causal attributions (Brown, 1986; Jones and Nisbett, 1972) and specifically given the finding that the more abstract and removed the task the less meaning it has for the younger child (cf Shultz and Butkowsky, 1977). Hypothetical techniques are clearly more removed and abstract. The open and direct methods employed here, it is thus argued, have greater ecological validity and hence should be used in future studies.

CHAPTER 8

CONCLUSION

8.1 A NOTE ON METHODOLOGICAL APPROACH

The present study has been broad. It has examined the relationship between metacognition and attributional behaviour amongst primary school children using an experimental methodology in which learning conditions have been controlled. In comparison with much current developmental research, the size of the sample of children studied was large. As a consequence, the results obtained are general rather than specific.

The advantage of the approach taken is that it allows generalisation. In contrast to intensive small scale studies and case work approaches which would provide fine details of the relationship between metacognition and attribution behaviour, the present study has provided an overview. The larger sample size has allowed a statistical analysis of the data from which we can make predictions about the effects of metacognition on attributional behaviour of similar groups of children. The control of learning conditions has, by removing some of the complex effects of a naturalistic setting, allowed a clearer understanding of the specific effects processing and outcome definition have on attribution. Placed against this approach, however, is the sacrifice of finer detail by taking a more quantitative and general approach. The study has not permitted the examination of the range of individual responses or of the relationship between metacognition and attribution in a naturalistic environment.

Whilst in the choice of research procedure the ecological validity of findings was of great concern, the study falls short of being a "naturalistic" study. Children worked individually with the experimenter and were withdrawn from ordinary classroom environments. The control of learning conditions limited the number of variables to which the child might attend. The "task focus" evident in the responses of children in the study may be one effect of the controlled learning situation. Classroom observation and perhaps ethnographic studies of individual children would present the information on the relationship between metacognition and attributional behaviour in the complex classroom environment.

The value of the present study then is one of identifying in a controlled condition the effect of metacognition and learning conditions on attributional behaviour. The need for alternative methodologies to provide the finer detail of process, individual difference and effects in the classroom environment is acknowledged.

8.2 RECOMMENDATIONS FOR FURTHER RESEARCH

Within the methodological approach adopted, the present study has examined a range of related issues concerned with the relationship between metacognition and attribution for learning outcome amongst primary school children. Whilst this approach had the advantage of giving an overview of a number of interconnected relationships, the nature of metacognition, the effects of development, the effects of outcome definition and of processing might each have been studied in its own right. The recommendations for further research propose more detailed investigation of the range of issues addressed here.

Of the further studies indicated by the present work, an investigation of the nature of metacognition is most prominent. The problems encountered in the identification and measurement of metacognition is symptomatic of the present state of literature and research in the field. Recommendations for further research are thus both theoretical and empirical:

(i) There is a need to clarify the definition of metacognition. The range of phenomena which might be classed as metacognitive is, at present, indefinite. The broad and indefinite parameters of metacognition are such that the concept is difficult to work with in practice. If metacognition is to be retained as a viable construct for empirical investigation in Education and Psychology, the definition must be tightened to a central notion. Alternatively, a classification system of metacognitive phenomena might be developed.

(ii) There is a need for further examination of the measurement of metacognition. Studies of the reliability and validity of existing measures are required as well as the development of general, process based measures.

(iii) There is a need to examine the relationship between metacognition and language. The measurement of metacognition is inevitably dependent on the child's linguistic ability. The relationship between the two requires further investigation.

The results of the present study revealed patterns of attribution which differed from those typically reported in the literature. This finding was ascribed to the research methods adopted. The use of direct learning tasks and open ended methods to elicit attributions produced an evident "task focus" in the children's attributions. This finding indicates that:

(iv) There is a need for continuing examination of the effects of research context and research method on attribution for learning outcome.

(v) There is a need for more studies employing open ended methods to elicit attribution and for studies which employ direct learning tasks. Open ended tasks account for the limitations of children's understanding of language and attribution concepts (Task, Ability, Luck and Effort). Direct learning experience is more "concrete" and is likely to present a better representation of the child's causal reasoning than abstract hypothetical techniques. It will increase the ecological validity of findings.

The examination of the effects of learning context (outcome definition and processing) on attribution in the present study has been necessarily limited. The examination of outcome definition only considered the difference between external and self-defined groups. It did not examine the difference in each group. Further, criteria used to define learning outcome were inferred from attributions rather than directly examined. The examination of the effect of processing orientation, similarly, examined only two orientations: Verbatim and Meaningful. Further studies might extend the examination of outcome definition and processing initiated in the present study:

(vi) The criteria used by children to define learning outcome might be directly examined.

(vii) The relationship between task type and criteria used to define learning outcome might be examined.

(viii) The effects of a range of processing orientations might be examined.

The results of the present study suggest that task structure has an influence on attribution for learning outcome. It is thus proposed that:

(ix) There is a need to examine the effect of task structure on attribution for learning outcome.

(x) There is a need to examine the relationship between metacognitive functioning and task structure.

Finally, the present study has examined the relationship between metacognition and attribution specific to the primary school age range. It is thus proposed that:

(xi) The examination of the relationship between metacognition and attribution might be extended to other age groups.

8.3 EDUCATIONAL IMPLICATIONS

The present study found only a weak relationship between metacognition and attribution for learning outcome. Nevertheless, some indication that metacognition has a positive influence on attribution behaviour was evident in the data. A developmental trend was evident with attribution to Strategy increasing with age and metacognition. A corresponding increase in Internal, Unstable, Specific and Controllable attributions was found. Metacognition also interacted with processing to affect attribution for learning outcome. Whilst attribution to Specific Ability increased following Verbatim processing, attribution to Knowledge increased following Meaningful processing. Moreover, the more structured Verbatim orientation led to more internal, controllable, specific and unstable attributions. This effect was more evident as metacognition increased.

With metacognition, a greater "task focus" was evident. Whilst with increased metacognitive development, children became aware of uncontrollable influences on learning outcome (an effect for the Uncontrollable attribution dimension was found), the focus was on those factors in the learning context over which they had control. It would seem that metacognitive understanding removes the focus from Ability and places it on Strategy and Effort.

The findings support recent studies which advocate metacognitive training in schools (Feuerstein et al., 1980; Weller and Craft, 1983; Heather and Vinson, 1988; Nisbett and Shucksmith, 1986). These studies have proposed that metacognitive training will facilitate both learning and motivation particularly for children of low ability. A variety of metacognitive instructional methods is proposed by these studies: content-free instruction (Feuerstein), teacher modelling, peer tutoring and direct instruction in self-monitoring (Nisbett and Shucksmith, 1986). Flavell (1979, 1981), in a similar vein, has suggested that children be taught to ask the attributional question "Why did I succeed / fail ?" as a self-monitoring strategy.

In the present study, attribution obtained following different processing type indicated Verbatim tasks were more motivating than Meaningful tasks. Children perceived they had greater responsibility and control over Verbatim tasks. It was suggested that the closed structure of the Verbatim task accounted for this effect. This finding suggests that to improve motivation for meaningful tasks there is a need to provide structure. The provision of proximal goals (Bandura and Schunk, 1981) or criteria against which to measure success on more open tasks may serve a motivating function. The possibility of training children to deal with open structure is also apparent. Children might be taught to provide their own criteria for judging successful completion of a task.

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APPENDIX 1: GENERATING STRATEGIES :
PROBLEMS FOR INTERVIEW PRESENTATION AND ASSOCIATED STIMULUS MATERIALS

The measure comprises six tasks, each an interview question. For two of these questions stimulus materials were used. Questions and stimulus materials are presented here.

Questions were presented in random order. They were assigned numbers for the purpose of identification, however.

<u>QUESTIONS</u>

Question 1

Suppose you were asked to learn a story like this one written here (present stimulus materials: seven year olds -*The Bank*, nine and eleven year olds - *Tasmania*). You have ten minutes to read and learn the story and then I will take it away and ask you about what you have learnt. You can do anything you want to learn the story.
What could you do?

Probe -Can you think of any other ways of learning the story? Think of all possible ways.

Question2

Suppose you were going swimming with your friend after school tomorrow and you wanted to be sure to remember your swimming things. How could you be really certain that you did not forget to bring your swimming things along to school in the morning?

Probe - Can you think of any other ways you could remember?
Think of all possible ways.

Question 3

Suppose you were invited to a birthday party for a friend. How could you make sure you remembered the party?

Probe - Can you think of anything else you could do? Think of all possible ways

---

Question 4

Suppose you lost your jacket/jumper/ cardigan/(whatever child is wearing) while you were at school. How could you go about finding it?

Probe - Is there anything else you could do? Think of all possible ways.

Question 5

Suppose your friend has a dog and you want to know how old the dog is. Your friend tells you he got him one Christmas but he can't remember which Christmas it was. What things could he do to help him remember which Christmas he got his dog?

Probe - Is there anything else he could do. Think of all possible ways.

Question 6

If you had to learn these words (present stimulus word list) so that you could tell me what they were later when you couldn't see them any more what could you do to help you learn and remember them now?

Probe - Can you think of any other ways. Think of all possible ways.

Example Story for Question 1 (7 year olds)

THE BANK

Everyone uses money. Some people keep their money in the bank so that it is safe . There are many different banks and they have branches in most shopping areas.

Because banks look after peoples money and valuables such as jewels and documents they must be safe and secure. Each morning the people who work at the bank carefully check the building to make sure nobody has broken in during the night and is waiting to steal money and valuables from the strong room.

The strong room is like an enormous safe. It is very secure. It has a thick safe door which is open during the day. Inside is another door which is made from metal bars. This is closed all the time . It is only opened if someone from the bank wants to collect something from inside. If a person who has stored money or valuable things at the bank wants to collect them from the bank they must prove who they are then fill in some forms before the person at the bank can enter the strong room to collect them. The bank has an alarm system which rings at the police station if there is any trouble.

Example Story for Question 1 (9 and 11 year olds)

TASMANIA

South of the large continent of Australia is an island called Tasmania.It was named after a Dutch explorer called Abel Tasman. Tasmania is a very beautiful island. It has many mountains and lakes. Some of the island is wilderness and is covered in thick forest like jungle. But Tasmania is not a hot place like many places that have jungles. It has weather that is quite like that we have in England.

Tasmania has some animals that are only found there. They are unique. Perhaps the most famous of these is the Tasmanian Devil.This is a black furry animal which is about the size of a small dog. It has sharp teeth and makes a very vicious noise. It is probably this terrible snarling sound that gave it its name. It is not dangerous to man. The Tasmanian Tiger is another unique Tasmanian animal. These are now thought to be extinct. Nobody has seen one now for many years. These animals were like stripey dogs with very long tails.

Example Word Lists for Question 6

9 and 11 year olds	7 Year olds
radio	dirt
black	goat
stone	door
apple	hand
river	blue
dress	kite
kites	drum
trick	pink
shirt	foot
ankle	bird

APPENDIX 2: ORGANISATION OF PROSE

The measure comprised 12 sentences. Each was printed in jumbo infant script and mounted on individual 5cm x 14 cm, cards. The sentences are reproduced here in reduced form. They are presented in theme groupings

The Fox		
He eats small animals.	He lives in a forest	He looks like a dog.
He catches birds for food.	He makes a home in the bushes.	His tail hangs down.
He sometimes eats fish.	Sometimes he stays in a hole.	He has a long nose
He likes fruit	He sleeps on the ground.	He is red.

ORGANISATION OF PROSE SENTENCE CARDS.

APPENDIX 3: WORD LIST GENERATION

Cue words presented here on single sheets were assembled in booklet form:one cue word per page. The order of collation was randomised for each booklet.

CUE WORDS: 7 YEAR OLDS

thin ________ ________ ________ ________

box ________ ________ ________ ________

smile ________ ________ ________ ________

knee ________ ________ ________ ________

hot ________ ________ ________ ________

touch ________ ________ ________ ________

CUE WORDS: 9 YEAR OLDS

whisper ________ ________ ________ ________

tent ________ ________ ________ ________

rough ________ ________ ________ ________

damp ________ ________ ________ ________

pen ________ ________ ________ ________

hide ________ ________ ________ ________

CUE WORDS: 11 YEAR OLDS

insect	________	________	________	________
pretend	________	________	________	________
crack	________	________	________	________
side	________	________	________	________
ugly	________	________	________	________
enormous	________	________	________	________

APPENDIX 4: JUDGING TASK DIFFICULTY

The measure comprised 10 word list pairs. Each was mounted on A4 card. Word list pairs are presented here with identification numbers These were not printed on the cards at the time of administration, however.

1.1

eyes nose cheeks mouth lips chin ears

eyes nose mouth chin

1.1

1.2

chair car tree book rat cloud

rat book chair cloud

1.2

13

dog horse cow goat pig

pig sheep goat horse cow hen dog

13

1.4

pencil ruler chalk

ruler chalk rubber pen pencil

2.1

ship	snail	rock	watch	table	sky
cat	snail	hen	dog	lion	cow

2.1

book	tree	orange	milk	nose
car	truck	van	lorry	bus

plate pot cup spoon glass

cup saucer plate knife fork

Farm animals give us many useful things. Cows and goats give us milk to drink. Sheep give us wool. Pigs give us meat and hens give us eggs to eat.

xx

cows goats sheep pigs hen

xx

car house chair lion apple

Mr Jones got out of his car and went into his house. He sat in his chair and stroked his cat who was called Lion while he munched an apple.

33.

Jan Julie Joanne Sam Simon

There are three girls called Jan, Julie and Joanne. Their names all begin with J. They have two brothers called Sam and Simon and their names begin with S.

33.

APPENDIX 5: SCORING OF GENERATING STRATEGIES

For each of the six questions a hierarchy of responses was derived. This was based on the results reported in the original study by Kreutzer et.al (1975). Because the questions presented very different problem types the scales, with the exception of questions two and three, differed. Each of these is outlined below.

Question 1: Learning from prose

Five levels of response strategy were derived for this question

(1) No strategy

eg. " I don't know"

(2) Read/Look

eg "I'd just read at it"

" Look at it"

(3)Internalisation :

Strategies aimed at "memorising" the materials: rehearsal, self testing, writing materials out verbatim

eg. "I'd say it over and over"

"I could test myself on what I remember then check"

(4) Association

Strategies which work with the structure or order of the materials to be learned: summarising, note-taking selective reading

eg. "I'd concentrate on the names of things and if I remember those I will remember other things about it"

"I'd write down all the main things"

(5.)Elaboration

Strategies which link materials to be learned with external knowledge and or structure: relating to existing knowledge, comparing, contrasting, advanced mnemonic skills

eg. "I could think about how Tasmania is like England and what things are different"

"I could think of other places I know like Tasmania"

Scores

None	0
Read/Look	1
Internalisation	2
Association	3
Elaboration	4

Questions Two and Three: Preparation Object and Preparation Event

Six levels of response were identified:

(1) No strategy

eg "I'm not sure"

(2) Mental Passive

Belief that own memory or that of another will not fail

eg "I would just remember"

"My Mum would remember"

(3) Mental active

Relying on a strategy of actively thinking to ensure memory. This includes checking and rehearsing responses

eg. " I would keep thinking about it so I wouldn't forget"

" I'd think about the party every day and check every day"

(4) Other

Notion that "two heads are better than one". Asking someone else to remember as a back up for one's own memory

eg. "I think I would remember because I like swimming but I could ask my friend to remind me"

" I'd ask Mum to remind me if I forgot".

(5) External Only

Strategy of using external aids such as notes or physical placement of a cue object

eg. "I could get my swimming kit out so, that I saw it and didn't forget"

"....write myself a note"

(6) External Put

Use of notes or physical placement of objects (as for 5 above) but with additional 'put' strategy which explicitly states that the note or object would be placed where there is a high probability of it being seen

eg . " I would write a note and put it on my bedroom door so I would see it when I went out in the morning"

" I would buy the present and put it on the sideboard where I would always see it and then I wouldn't forget"

Scores

None	0
Mental Passive	1
Mental Active	2
Others	3
External	4
External-Put	5

Question 4 : Retrieval Object

Five categories of response were derived:

(1) No Strategy / Accept loss

eg. " I'd have to go home without it"

(2) Unspecified Search:

Responses which suggest an exhaustive search with no specific search location mentioned or which suggests asking unspecified others to look

eg "Look everywhere"

"Get someone to help me"

(3)Specified Search :

Responses which suggest looking in likely places and checking established storage points for lost property

eg " Look in places I usually go"

" Look in the lost property basket"

(4) Specified people

Asking named others if they had seen the object or to assist in the search

eg . "Ask my friends if they have seen it"

"Ask Mrs C to look for it"

(5) Ordered Search

Responses with specified stepwise plan of action such as retracing steps or an ordered search (indicated by linking words "then", "afterwards" etc)

eg " I would look in the last place I remembered having it then I would go all around the places I had been after that until I found it"

"I would look in the most likely places first and if I didn't find it I would look in the next most likely and work like that"

Scores

No strategy/accept loss	0
Unspecified search	1
Specified search	2
Specified people	2
Ordered search	3

Question 5 : Retrieval event

Six response categories were derived

(1). No Strategy/Tautological

Responses in which no strategy is offered or the task is repeated

eg "You'd have to find the age of the dog"

"I'd write it down"

"I wouldn't know the age of the dog"

(2)Internal-Passive

Notion that the child would just remember

eg . " he would probably remember"

(3) External-Improbable

Search for some source of evidence which is unlikely to exist

eg. " You might have written it on a calendar and you could look at that"

(4) External probable

Strategy involving either direct observation of the dog or search for source of evidence which is likely to exist (eg kennel papers or asking significant other)

eg "You might have the papers from when you bought him or when you took him to the vet for injections and that would tell you"

"If your parents gave you the dog they might remember how long ago it was"

(5) Direct Elaboration

Strategy involving a mental "tracing back" of Christmases past or of the events associated with receiving the dog which might indicate a time dimension eg. "I would try to remember when I got the dog and what happened then"

"I would think back through all the Christmases and try to think of the ones when I had the dog and when I didn't"

(6) Indirect elaboration

Strategy of linking another occurrence or event that coincided with the arrival of the dog.

eg. "I could think about other presents I got at the same time and think about how old they are"

Scores

No Strategy/ Tautological	0
Internal Passive	1
External Improbable	1
External Probable	2
Direct elaboration	3
Indirect Elaboration	4

Question 6 ; Learning a List

Five categories of response were derived:

(1) No Strategy -

Child unable to provide a strategy

(2) Look/Read

Strategy of looking at the words or reading only once (this is assumed if the child does not indicate repeated reading)

eg. "I'd just read it"

(3) Rehearse

This includes saying the words over, testing, spelling and writing out.

eg. "I'd think of them over and over in my head"

(4) Association

Strategies involving the use of ordering, mnemonics (eg making rhymes , making sentences), simple imagery (picturing each item or word)

eg "I'd see this word chair and I would think about a chair in my head.then I would think of dress"

"I'd put all the words in alphabetical order and the I could go through the alphabet to remember them. I would say *was there a word beginning with B* "

(5) Elaboration

Strategies involving grouping, categorising, coordinated imagery, making a story with the words

eg " I would make a story with all the words (went on to illustrate)"

"I could put all the words that are about the same thing together... like blue and black they are colours "

Scores

No Strategy	0
Look/Read	1
Rehearse	2
Association	3
Elaboration	4

APPENDIX 6: SCORING OF ORGANISATION OF PROSE

Three scales were scored:

1. Organisation of Sentence
2. Theme Recognition
3. Theme Selection

Organisation of Sentences

The scoring system was adopted from the original study by Danner (1976).It was based on a simple count of grouping of sentences by theme. Responses were coded into four categories

(i) *"Unorganised"*

Responses have no discernable organisation. Theme related sentence are generally not placed together

(ii) *Partial Organisation A*

Theme related sentences are placed together in groups of two and three

(iii) *Partial Organisation B*

Theme related sentences are placed together in groups of three and four

(iv) *Complete Organisation*

Sentences are organised by theme with all four sentences from each of the three themes placed together.

Scores

"Unorganised"	1
Partial A	2
Partial B	3
Complete	4

Theme Recognition

A simple dichotomous coding system was employed which signified presence or absence of theme recognition

Scores

Recognised	1 point
Not recognised	0 points

Theme Selection

A simple dichotomous coding system was again employed.

Scores

Selected	1 point
Failed to select	0 points

APPENDIX 7 : SCORING OF WORD LIST GENERATION

Scoring of Word List Generation was concerned with two aspects of the response

i. Principle of organisation used

ii .Consistency/ cohesion of the word string generated

A three tiered hierarchy of responses was derived. Each level of the hierarchy represented a qualitatively different level of response with the degree of consistency/cohesion increasing with each level. Within each level of the hierarchy a number of responses of equal status were identified. This system is summarised in Table (A7)and described in full below.

TABLE (A7): SUMMARY OF THREE HIERARCHICAL LEVELS FOR SCORING OF WORD LIST GENERATION

Level 1 : Individual Functions

Graphic
Phonic
Function
Description
Category

Level 2 : Co-ordinated Functions

Story Image
Taxonomic Category

Level 3 : Specific co-ordinated Functions

Semantic Story Image
Narrow Taxonomic Category

Description of Categories.

Level 1 : Individual Functions

Graphic :
Words generated have visual similarity.

Score if

(1) All words chosen are of the same length

(2) All words have the same beginning letter of consonant blend

(3) A letter grouping is repeated in three or more of the words eg. consonant blends, prefix, suffix

Phonic :
Words generated have sound relationships. Generally this will mean the words rhyme

Score if

Three or more words rhyme or could be construed as rhyming eg "spear" and "spire" do not rhyme but may be thought to do so.

Function :
Words generated are related in terms of their function

Score if any word fits into the frame

(1) Cue word can be used to ....

(2) Cue word can be ......ed

(3) Cue word is good for ....ing

Description :
Words generated are related in terms of their attributes.

Score if

(1) For nouns - appropriate adjective is generated

(2) For verbs - appropriate adverb generated

(3) For adjective - nouns which have that attribute are generated

(4) For adverbs - verbs which have that attribute are generated

Category
Words generated have a categorical relationship

Score if any word fits the frame

(1) Cue word is a .... category member

(2) Cue word belongs to the category ....

Level 2 ; Co-ordinated Functions

Taxonomic Category
Words generated have , semantic hierarchical relationship. They belong to the same calss or category of objects. they can be grouped together by some common attribute.

Score if

(1) All words belong to the same broad category

(2) One word names the category and all others belong to it.

Story Image
In some cases individual words generated do not relate to the cue word in terms of graphic phonic or semantic/hierarchical category but are organised by an external principle - story or image

Score if

(1) All the words in combination evoke a story or image

(2) The words spell out a sentence

Level 3 : Specific Co-ordinated Functions

Narrow Category
All five words (cue word and four generated) are semantically proximate. They form a sub-category of a broad taxonomic category

Score if

(1) Specific thematic principles are used eg. synonyms/antonyms, narrowly inclusive category

(2) A principle of ordering the five words is evident. Ordering , for example, may be based on size (eg.enormous huge large medium small) alphabet , chronology

Semantic Story Image :
Words generated not only evoke an image but utilise the meaning of the cue word also.

Score if

words generated are used to write a sentence which in addition gives information to aid retrieval

eg. cue word "rough"

response : rough is opposite of smooth

Scores

Level 1	1 point (each principle)
Level 2	2 points
Level 3	4 points

A cumulative scoring system was employed. Scores represented an aggregation of points awarded for all demonstrations of organisation both within and across the three levels. The rationale for this scoring was the notion of memory trace redundancies.It was reasoned that the greater number of memory trace the greater the probability of recall.Thus a child who generates a list in which the words have both graphic and semantic relationship is viewed as more metacognitively advanced than a child who employs only one of these organisational principles.

APPENDIX 8: SCORING OF JUDGING TASK DIFFICULTY

Two variables were scored:

1. Selection of task

2. Rationale provided for choice

1. SELECTION

Correct choice was predetermined by assignment of points for difficulty based:

(i). number of items

(ii) relatedness of items

(iii) meaningfulness of presentation of items

(i) Number of items
One point was assigned for each item in the list

eg. cat dog rabbit (3 points)

cat dog rabbit goat fish cow (6 points)

(ii) Relatedness of items

Points were assigned as follows

(1) High -all items belong to a specific category (1 point)

(2) Moderate -all items belong to a broad category (2 points)

(3) Low no discernable relationship between the items (3 points)

eg. mother father sister brother (1 point)

dog rabbit cow goat (2 points)

leg ball coat straw (3 points)

(iii) Meaningfulness

Items were presented as ordinary word lists or were presented as embedded lists in sentences.Embedded lists were designed to assist meaning by giving a medium for recall. Difficulty points were thus:

word list	2 points
embedded	1 point

eg. Susan Sally Sandra Jim John (2 points)

Susan Sally and Sandra are sisters and their names begin with S. John and Jim are brothers and their names begin with J. (1 point)

Scores

correct selection	1 point
incorrect selection	0 points

2. Rationale

Responses were categorised into four categories

(i) *Standard*
Rationale given corresponds to :

Set One items : number of items
Set Two items : relatedness of items
Set Three items : meaningfulness of item presentation

(ii) *Alternative*
Rationale is not a standard rationale but is valid

(iii) *Inappropriate*
A rationale is offered but it is either "unprincipled" (eg.I just liked them better) or incorrect (eg.more words are easier to learn)

(iv) *No rationale given*
No rationale is provided (eg."I don't know)

Scores

Standard	3 points
Alternative	2
Inappropriate	1
None	0

EXAMPLE RESPONSES FOR SCORING

Set One Items : Principle of number

Inappropriate (score 1)

" I like the words"

" They are easy to read"

" They are all animals" (NB. relatedness of items in each list is held constant)

Alternative (score 2)

Responses which present the notion of inclusiveness or imagery

"There are more words but they make a better picture of a face"

"They are all farm animals and it is easier to remember more of them"

Appropriate (score 3)

All responses which suggest that a smaller number of items is easier to remember

"There are less things to remember"

Set Two Items : Principle of Relatedness

Inappropriate (score 1)

"There are more to remember"

"I like the words"

"These are smaller words"

also any wrongly selected item for which rationale given as the reason for choice. In some items both lists are related and the appropriate choice is the list which has item more closely related

Alternative (score2)

Item 2.3 if the child says for this item " they are all containers"

Appropriate

"They are all animals"

"They are all people in your family"

"These ones are more the same"

Set Three Items : Principle of Meaningfulness

Inappropriate (score 1)

"The sentence is harder"

"The list is less"

"They are the same because they have got the same number of words"

Alternative (score2)

Responses which comment on the nature of the sentence

"The words are all animals so the sentence doesn't help me any more but it would if the words were different"

"I could make up my own sentence in my head and I would rememeber the words better with my own sentence"

Appropriate (score 3)

"The sentence helps you to remember the words.I only have to remember the story. That is easier to remember"

APPENDIX 9: PEARSON CORRELATIONS OF MOVES, STRATEGIES AND HIGHEST SCORE WITHIN EACH GENERATING STRATEGIES TASK

TASK 1

	GSAM	GSAS	GSAHS
GSAM	1.0000 (0) P= .	.6585 (144) P= .000	.3757 (144) P= .000
GSAS	.6585 (144) P= .000	1.0000 (0) P= .	.3203 (144) P= .000
GSAHS	.3757 (144) P= .000	.3203 (144) P= .000	1.0000 (0) P= .

TASK 2

	GSBM	GSBS	GSBHS
GSBM	1.0000 (0) P= .	.8342 (144) P= .000	.4872 (144) P= .000
GSBS	.8342 (144) P= .000	1.0000 (0) P= .	.3648 (144) P= .000
GSBHS	.4872 (144) P= .000	.3648 (144) P= .000	1.0000 (0) P= .

TASK 3

	GSCM	GSCS	GSCHS
GSCM	1.0000 (0) P= .	.8704 (142) P= .000	.3726 (142) P= .000
GSCS	.8704 (142) P= .000	1.0000 (0) P= .	.2901 (142) P= .000
GSCHS	.3726 (142) P= .000	.2901 (142) P= .000	1.0000 (0) P= .

TASK 4

	GSDM	GSDS	GSDHS
GSDM	1.0000 (0) P= .	.6271 (143) P= .000	.2372 (143) P= .000
GSDS	.6271 (143) P= .000	1.0000 (0) P= .	.2400 (143) P= .002
GSDHS	.2372 (143) P= .000	.2400 (143) P= .002	1.0000 (0) P= .

TASK 5

	GSEM	GSES	GSEHS
GSEM	1.0000 (0) P= .	.9073 (144) P= .000	.4469 (144) P= .000
GSES	.9073 (144) P= .000	1.0000 (0) P= .	.4947 (144) P= .000
GSEHS	.4469 (144) P= .000	.4947 (144) P= .000	1.0000 (0) P= .

TASK 6

	GSFM	GSFS	GSFHS
GSFM	1.0000 (0) P= .	.6895 (143) P= .000	.2395 (143) P= .000
GSFS	.6895 (143) P= .000	1.0000 (0) P= .	.2253 (143) P= .003
GSFHS	.2395 (143) P= .000	.2253 (143) P= .003	1.0000 (0) P= .

APPENDIX 10: PEARSON CORRELATION OF MOVES, STRATEGIES AND HIGHEST SCORE WITHIN EACH GENERATING STRATEGIES TASK, FOR EACH AGE GROUP

TASK 1

7 YEARS

	GSAM	GSAS	GSAHS
GSAM	1.0000	.9534	.5511
	(0)	(43)	(43)
	P= .	P= .000	P= .000
GSAS	.9534	1.0000	.5370
	(43)	(0)	(43)
	P= .000	P= .	P= .000
GSAHS	.5511	.5370	1.0000
	(48)	(43)	(0)
	P= .000	P= .000	P= .

9 YEARS

	GSAM	GSAS	GSAHS
GSAM	1.0000	.6317	.4132
	(0)	(43)	(43)
	P= .	P= .000	P= .003
GSAS	.6317	1.0000	.4067
	(43)	(0)	(48)
	P= .000	P= .	P= .004
GSAHS	.4182	.4067	1.0000
	(48)	(43)	(0)
	P= .003	P= .004	P= .

11 YEARS

	GSAM	GSAS	GSAHS
GSAM	1.0000	.5805	.1022
	(0)	(48)	(43)
	P= .	P= .000	P= .437
GSAS	.5805	1.0000	.0142
	(43)	(0)	(43)
	P= .000	P= .	P= .924
GSAHS	.1022	.0142	1.0000
	(48)	(48)	(0)
	P= .489	P= .924	P= .

TASK 2

7 YEARS

	GSBM	GSBS	GSBHS
GSBM	1.0000 (0) P= .	.8913 (48) P= .000	.3669 (48) P= .010
GSBS	.8913 (48) P= .000	1.0000 (0) P= .	.3378 (48) P= .019
GSBHS	.3669	.3378	1.0000

9 YEARS

	GSBM	GSBS	GSBHS
GSBM	1.0000 (0) P= .	.9013 (48) P= .000	.5304 (48) P= .000
GSBS	.9013 (48) P= .000	1.0000 (0) P= .	.3749 (48) P= .009
GSBHS	.5304 (48) P= .000	.3749 (48) P= .009	1.0000 (0) P= .

11 YEARS

	GSBM	GSBS	GSBHS
GSBM	1.0000 (0) P= .	.8351 (48) P= .000	.3246 (48) P= .024
GSBS	.8351 (48) P= .000	1.0000 (0) P= .	.1218 (48) P= .410
GSBHS	.3246 (48) P= .024	.1218 (48) P= .410	1.0000 (0) P= .

TASK 3

7 YEARS

	GSCM	GSCS	GSCHS
GSCM	1.0000 (0) P= .	.9084 (48) P= .000	.3293 (48) P= .022
GSCS	.9084 (48) P= .000	1.0000 (0) P= .	.2832 (48) P= .051
GSCHS	.3293 (48) P= .022	.2832 (48) P= .051	1.0000 (0) P= .

9 YEARS

	GSCM	GSCS	GSCHS
GSCM	1.0000 (0) P= .	.8950 (48) P= .000	.4544 (48) P= .001
GSCS	.3950 (48) P= .000	1.0000 (0) P= .	.2304 (48) P= .054
GSCHS	.4544 (48) P= .001	.2304 (48) P= .054	1.0000 (0) P= .

11 YEARS

	GSCM	GSCS	GSCHS
GSCM	1.0000 (0) P= .	.8212 (46) P= .000	.2666 (46) P= .073
GSCS	.3212 (46) P= .000	1.0000 (0) P= .	.2331 (46) P= .111
GSCHS	.2666 (46) P= .073	.2331 (46) P= .111	1.0000 (0) P= .

TASK 4

7 YEARS

	GSDM	GSDS	GSDHS
GSDM	1.0000 (0) P= .	.8911 (48) P= .000	.3965 (43) P= .005
GSDS	.8911 (48) P= .000	1.0000 (0) P= .	.4200 (48) P= .003
GSDHS	.3965 (48) P= .005	.4200 (48) P= .003	1.0000 (0) P= .

9 YEARS

	GSDM	GSDS	GSDHS
GSDM	1.0000 (0) P= .	.6019 (48) P= .000	.1558 (48) P= .290
GSDS	.6019 (48) P= .000	1.0000 (0) P= .	.1073 (48) P= .468
GSDHS	.1558 (48) P= .290	.1073 (48) P= .468	1.0000 (0) P= .

11 YEARS

	GSDM	GSDS	GSDHS
GSDM	1.0000 (0) P= .	.4819 (47) P= .001	.1385 (47) P= .204
GSDS	.4319 (47) P= .001	1.0000 (0) P= .	.0805 (47) P= .591
GSDHS	.1335 (47) P= .204	.0805 (47) P= .591	1.0000 (0) P= .

TASK 5

7 YEARS

	GSEM	GSES	GSEMS
GSEM	1.0000 (0) P= .	.9504 (48) P= .000	.6079 (48) P= .000
GSES	.9504 (48) P= .000	1.0000 (0) P= .	.6520 (48) P= .000
GSEMS	.6079 (48) P= .000	.6520 (48) P= .000	1.0000 (0) P= .

9 YEARS

	GSEM	GSES	GSEMS
GSEM	1.0000 (0) P= .	.9032 (48) P= .000	.3943 (48) P= .005
GSES	.9032 (48) P= .000	1.0000 (0) P= .	.4640 (48) P= .001
GSEMS	.3943 (48) P= .005	.4640 (48) P= .001	1.0000 (0) P= .

11 YEARS

	GSEM	GSES	GSEMS
GSEM	1.0000 (0) P= .	.8743 (48) P= .000	.2660 (48) P= .068
GSES	.8743 (48) P= .000	1.0000 (0) P= .	.2769 (48) P= .057
GSEMS	.2660 (48) P= .068	.2769 (48) P= .057	1.0000 (0) P= .

TASK 6

7 YEARS

	GSFH	GSFS	GSFHS
GSFH	1.0000 (0) P= .	.8760 (47) P= .000	.3511 (47) P= .016
GSFS	.8760 (47) P= .000	1.0000 (0) P= .	.4029 (47) P= .005
GSFHS	.3511 (47) P= .016	.4029 (47) P= .005	1.0000 (0) P= .

9 YEARS

	GSFH	GSFS	GSFHS
GSFH	1.0000 (0) P= .	.8237 (48) P= .000	.1930 (43) P= .139
GSFS	.8237 (48) P= .000	1.0000 (0) P= .	.1535 (48) P= .293
GSFHS	.1930 (48) P= .139	.1535 (48) P= .298	1.0000 (0) P= .

11 YEARS

	GSFH	GSFS	GSFHS
GSFH	1.0000 (0) P= .	.4931 (48) P= .000	.2088 (43) P= .154
GSFS	.4931 (43) P= .000	1.0000 (0) P= .	.1813 (48) P= .218
GSFHS	.2033 (43) P= .154	.1813 (48) P= .218	1.0000 (0) P= .

APPENDIX 11: PEARSON CORRELATION MATRICES OF LIKE VARIABLES ACROSS SIX GENERATING STRATEGIES TASKS

	GSAM	GSBM	GSCM	GSDM	GSEM	GSFM
GSAM	1.0000 (0) P= .	.3043 (144) P= .000	.2592 (142) P= .002	.2501 (143) P= .003	.2956 (144) P= .000	.2418 (143) P= .004
GSBM	.3043 (144) P= .000	1.0000 (0) P= .	.3307 (142) P= .000	.2335 (143) P= .004	.2659 (144) P= .001	.2960 (143) P= .000
GSCM	.2592 (142) P= .002	.3307 (142) P= .000	1.0000 (0) P= .	.4435 (141) P= .000	.4005 (142) P= .000	.3420 (141) P= .000
GSDM	.2501 (143) P= .003	.2385 (143) P= .004	.4436 (141) P= .000	1.0000 (0) P= .	.4334 (143) P= .000	.3363 (142) P= .000
GSEM	.2956 (144) P= .000	.2659 (144) P= .001	.4005 (142) P= .000	.4334 (143) P= .000	1.0000 (0) P= .	.2405 (143) P= .004
GSFM	.2418 (143) P= .004	.2960 (143) P= .000	.3420 (141) P= .000	.3363 (142) P= .000	.2405 (143) P= .004	1.0000 (0) P= .

PEARSON CORRELATION OF MOVES ACROSS GENERATING STRATEGIES TASKS

	GSAS	GSBS	GSCS	GSDS	GSES	GSFS
GSAS	1.0000 (0) P=	.1615 (144) P= .053	.1935 (142) P= .021	.1527 (143) P= .069	.0856 (144) P= .308	.2373 (143) P= .004
GSBS	.1615 (144) P= .053	1.0000 (0) P= .	.3404 (142) P= .000	.1445 (143) P= .085	.1928 (144) P= .021	.2016 (143) P= .016
GSCS	.1935 (142) P= .021	.3404 (142) P= .000	1.0000 (0) P= .	.2683 (141) P= .001	.2887 (142) P= .000	.1575 (141) P= .062
GSDS	.1527 (143) P= .069	.1445 (143) P= .085	.2683 (141) P= .001	1.0000 (0) P= .	.2777 (143) P= .001	.2074 (142) P= .013
GSES	.0856 (144) P= .303	.1928 (144) P= .021	.2887 (142) P= .000	.2777 (143) P= .001	1.0000 (0) P= .	.0925 (143) P= .272
GSFS	.2373 (143) P= .004	.2016 (143) P= .016	.1575 (141) P= .062	.2074 (142) P= .013	.0925 (143) P= .272	1.0000 (0) P= .

PEARSON CORRELATION OF STRATEGIES ACROSS GENERATING STRATEGIES TASKS

	GSAHS	GSBHS	GSCHS	GSDHS	GSEHS	GSFHS
GSAHS	1.0000 (0) P= .	.1043 (144) P= .214	.0041 (142) P= .961	.1075 (143) P= .201	.1185 (144) P= .157	.2044 (143) P= .014
GSBHS	.1043 (144) P= .214	1.0000 (0) P= .	.1691 (142) P= .044	.0687 (143) P= .415	.2711 (144) P= .001	.2082 (143) P= .013
GSCHS	.0041 (142) P= .961	.1691 (142) P= .044	1.0000 (0) P= .	.1327 (141) P= .117	.1328 (142) P= .029	.1573 (141) P= .063
GSDHS	.1075 (143) P= .201	.0687 (143) P= .415	.1327 (141) P= .117	1.0000 (0) P= .	.1781 (143) P= .033	.1346 (142) P= .110
GSEHS	.1185 (144) P= .157	.2711 (144) P= .001	.1828 (142) P= .029	.1781 (143) P= .033	1.0000 (0) P= .	.2862 (143) P= .001
GSFHS	.2044 (143) P= .014	.2082 (143) P= .013	.1573 (141) P= .063	.1346 (142) P= .110	.2862 (143) P= .001	1.0000 (0) P= .

PEARSON CORRELATION OF HIGHEST SCORE ACROSS GENERATING STRATEGIES TASKS

APPENDIX 12: PEARSON CORRELATION OF LIKE VARIABLES ACROSS GENERATING STRATEGIES TASKS FOR EACH AGE GROUP

	GSAS	GSBS	GSCS	GSDS	GSES	GSFS
GSAS	1.0000 (0) P= .	.2100 (48) P= .152	.1944 (48) P= .185	.2297 (48) P= .116	.1604 (48) P= .276	.1717 (47) P= .248
GSBS	.2100 (48) P= .152	1.0000 (0) P= .	.2458 (48) P= .092	.2088 (48) P= .154	.1098 (48) P= .457	.0921 (47) P= .538
GSCS	.1744 (48) P= .135	.2458 (48) P= .092	1.0000 (0) P= .	.3411 (48) P= .018	.2740 (48) P= .059	.1847 (47) P= .214
GSDS	.2297 (48) P= .116	.2088 (48) P= .154	.3411 (48) P= .018	1.0000 (0) P= .	.4935 (48) P= .000	.3013 (47) P= .040
GSES	.1604 (48) P= .276	.1098 (48) P= .457	.2740 (48) P= .059	.4935 (48) P= .000	1.0000 (0) P= .	.0273 (47) P= .855
GSFS	.1717 (47) P= .248	.0921 (47) P= .538	.1847 (47) P= .214	.3013 (47) P= .040	.0273 (47) P= .855	1.0000 (0) P= .

PEARSON CORRELATION OF STRATEGIES ACROSS GENERATING STRATEGIES TASKS, 7 YEAR OLDS

PAGE NUMBERING AS ORIGINAL

	GSAS	GSBS	GSCS	GSDS	GSES	GSFS
GSAS	1.0000 (0) P= .	.2535 (48) P= .082	.1998 (48) P= .173	.1839 (43) P= .211	-.0294 (48) P= .843	.2905 (48) P= .045
GSBS	.2535 (48) P= .082	1.0000 (0) P= .	.4513 (48) P= .001	.0020 (48) P= .989	.1023 (48) P= .489	.2680 (48) P= .066
GSCS	.1993 (48) P= .173	.4513 (48) P= .001	1.0000 (0) P= .	.3151 (48) P= .029	.2931 (48) P= .043	.2597 (48) P= .075
GSDS	.1339 (48) P= .211	.0020 (48) P= .989	.3151 (43) P= .029	1.0000 (0) P= .	.0394 (48) P= .790	.2563 (48) P= .079
GSES	-.0294 (48) P= .343	.1023 (48) P= .489	.2931 (48) P= .043	.0394 (48) P= .790	1.0000 (0) P= .	.0933 (48) P= .528
GSFS	.2905 (43) P= .045	.2680 (48) P= .066	.2597 (48) P= .075	.2563 (48) P= .079	.0933 (48) P= .523	1.0000 (0) P= .

PEARSON CORRELATION OF STRATEGIES ACROSS GENERATING STRATEGIES TASKS, 9 YEAR OLDS

	GSAS	GSBS	GSCS	GSDS	GSES	GSFS
GSAS	1.0000 (0) P= .	.1204 (48) P= .415	.1851 (46) P= .218	.0450 (47) P= .764	.1747 (48) P= .235	.2188 (48) P= .135
GSBS	.1204 (43) P= .415	1.0000 (0) P= .	.2456 (46) P= .100	.1334 (47) P= .205	.2334 (48) P= .110	.1117 (48) P= .450
GSCS	.1851 (46) P= .213	.2456 (46) P= .100	1.0000 (0) P= .	.1204 (45) P= .431	.2258 (46) P= .131	-.0738 (46) P= .626
GSDS	.0450 (47) P= .764	.1884 (47) P= .205	.1204 (45) P= .431	1.0000 (0) P= .	.2673 (47) P= .069	.0151 (47) P= .920
GSES	.1747 (48) P= .235	.2334 (48) P= .110	.2258 (46) P= .131	.2673 (47) P= .069	1.0000 (0) P= .	.0746 (48) P= .615
GSFS	.2188 (48) P= .135	.1117 (48) P= .450	-.0733 (46) P= .626	.0151 (47) P= .920	.0746 (48) P= .615	1.0000 (0) P= .

PEARSON CORRELATION OF STRATEGIES ACROSS GENERATING STRATEGIES TASKS, 11 YEAR OLDS

	GSAM	GSBM	GSCM	GSDM	GSEM	GSFM
GSAM	1.0000 (0) P= .	.1153 (48) P= .435	.2206 (48) P= .132	.2684 (48) P= .065	.2353 (48) P= .107	.1592 (47) P= .285
GSBM	.1153 (48) P= .435	1.0000 (0) P= .	.2329 (48) P= .111	.2525 (48) P= .083	.1752 (48) P= .234	.0029 (47) P= .985
GSCM	.2206 (48) P= .132	.2329 (48) P= .111	1.0000 (0) P= .	.4682 (48) P= .001	.4044 (48) P= .004	.1980 (47) P= .182
GSDM	.2684 (48) P= .065	.2525 (48) P= .083	.4682 (48) P= .001	1.0000 (0) P= .	.3994 (48) P= .005	.3962 (47) P= .006
GSEM	.2353 (48) P= .107	.1752 (48) P= .234	.4044 (48) P= .004	.3994 (48) P= .005	1.0000 (0) P= .	.0967 (47) P= .518
GSFM	.1592 (47) P= .285	.0029 (47) P= .985	.1980 (47) P= .182	.3962 (47) P= .006	.0967 (47) P= .518	1.0000 (0) P= .

PEARSON CORRELATION OF MOVES ACROSS GENERATING STRATEGIES TASKS , 7 YEAR OLDS

	GSAM	GSBM	GSCM	GSDM	GSEM	GSFM
GSAM	1.0000 (0) P= .	.3463 (48) P= .016	.2948 (48) P= .042	.2589 (48) P= .076	.2406 (48) P= .099	.3700 (48) P= .010
GSBM	.3463 (48) P= .016	1.0000 (0) P= .	.3732 (48) P= .009	.1275 (48) P= .388	.0520 (48) P= .726	.4031 (48) P= .005
GSCM	.2948 (48) P= .042	.3732 (48) P= .009	1.0000 (0) P= .	.3277 (48) P= .023	.3014 (48) P= .037	.3364 (48) P= .019
GSDM	.2589 (48) P= .076	.1275 (48) P= .388	.3277 (48) P= .023	1.0000 (0) P= .	.4467 (48) P= .001	.2033 (48) P= .165
GSEM	.2406 (48) P= .099	.0520 (48) P= .726	.3014 (48) P= .037	.4467 (48) P= .001	1.0000 (0) P= .	.0880 (48) P= .552
GSFM	.3700 (48) P= .010	.4031 (48) P= .005	.3364 (48) P= .019	.2033 (48) P= .165	.0880 (48) P= .552	1.0000 (0) P= .

PEARSON CORRELATION OF MOVES ACROSS GENERATING STRATEGIES TASKS , 9 YEAR OLDS

	GSAM	GSBM	GSCM	GSDM	GSEM	GSFM
GSAM	1.0000 (0) P= .	.2312 (48) P= .114	.1642 (46) P= .276	.1066 (47) P= .476	.2907 (48) P= .045	.0451 (48) P= .761
GSBM	.2312 (48) P= .114	1.0000 (0) P= .	.2559 (46) P= .086	.1440 (47) P= .334	.3746 (48) P= .009	.1866 (48) P= .204
GSCM	.1642 (46) P= .276	.2559 (46) P= .036	1.0000 (0) P= .	.4612 (45) P= .001	.4140 (46) P= .004	.3599 (46) P= .014
GSDM	.1066 (47) P= .476	.1440 (47) P= .334	.4612 (45) P= .001	1.0000 (0) P= .	.3767 (47) P= .009	.3173 (47) P= .030
GSEM	.2907 (48) P= .045	.3746 (48) P= .009	.4140 (46) P= .004	.3767 (47) P= .009	1.0000 (0) P= .	.3500 (48) P= .015
GSFM	.0451 (48) P= .761	.1866 (48) P= .204	.3599 (46) P= .014	.3173 (47) P= .030	.3500 (48) P= .015	1.0000 (0) P= .

PEARSON CORRELATION OF MOVES ACROSS GENERATING STRATEGIES TASKS ,11 YEAR OLDS

	GSAHS	GSBHS	GSCHS	GSDHS	GSEHS	GSFHS
GSAHS	1.0000	.2152	-.2082	.0114	-.0178	-.0356
	(0)	(48)	(48)	(48)	(48)	(47)
	P= .	P= .142	P= .156	P= .939	P= .904	P= .812
GSBHS	.2152	1.0000	-.0600	-.0358	.0170	-.0792
	(43)	(0)	(48)	(48)	(48)	(47)
	P= .142	P= .	P= .685	P= .809	P= .908	P= .597
GSCHS	-.2082	-.0600	1.0000	-.0136	.1481	.2717
	(43)	(48)	(0)	(48)	(48)	(47)
	P= .156	P= .685	P= .	P= .900	P= .315	P= .065
GSDHS	.0114	-.0358	-.0186	1.0000	.0971	.2103
	(43)	(48)	(48)	(0)	(48)	(47)
	P= .939	P= .309	P= .900	P= .	P= .512	P= .156
GSEHS	-.0173	.0170	.1481	.0971	1.0000	.1782
	(48)	(48)	(48)	(48)	(0)	(47)
	P= .704	P= .908	P= .315	P= .512	P= .	P= .231
GSFHS	-.0356	-.0792	.2717	.2103	.1732	1.0000

Pearson Correlation of Highest Score Across Generating Strategies Tasks, 7 Year Olds

	GSAHS	GSBHS	GSCHS	GSDHS	GSEHS	GSFHS
GSAHS	1.0000 (0) P= .	-.0114 (48) P= .938	.3355 (48) P= .020	.3042 (48) P= .036	.3165 (48) P= .028	.1420 (48) P= .336
GSBHS	-.0114 (48) P= .938	1.0000 (0) P= .	.2103 (48) P= .151	.0608 (48) P= .681	.0460 (48) P= .756	.0726 (48) P= .624
GSCHS	.3355 (48) P= .020	.2103 (48) P= .151	1.0000 (0) P= .	.2988 (48) P= .039	.2169 (48) P= .139	.1097 (48) P= .458
GSDHS	.3042 (48) P= .036	.0608 (48) P= .681	.2988 (48) P= .039	1.0000 (0) P= .	.3159 (48) P= .029	.0726 (48) P= .624
GSEHS	.3165 (48) P= .028	.0460 (48) P= .756	.2169 (48) P= .139	.3159 (48) P= .029	1.0000 (0) P= .	.1908 (48) P= .194
GSFHS	.1420 (48) P= .336	.0726 (48) P= .624	.1097 (48) P= .458	.0726 (48) P= .624	.1908 (48) P= .194	1.0000 (0) P= .

PEARSON CORRELATION OF HIGHEST SCORE ACROSS GENERATING STRATEGIES TASKS, 9 YEAR OLDS

	GSAHS	GSBHS	GSCHS	GSDHS	GSEHS	GSFHS
GSAHS	1.0000 (0) P= .	-.1888 (48) P= 199	-.1171 (46) P= .438	.0757 (47) P= .613	-.0155 (48) P= .917	.3987 (48) P= .005
GSBHS	-.1888 (48) P= .199	1.0000 (0) P= .	.1220 (46) P= .419	-.1389 (47) P= .352	.4901 (48) P= .000	.2257 (48) P= .123
GSCHS	-.1171 (46) P= .438	.1220 (46) P= .419	1.0000 (0) P= .	.1433 (45) P= .348	-.0074 (46) P= .961	-.0115 (46) P= .939
GSDHS	.0757 (47) P= .613	-.1389 (47) P= .352	.1433 (45) P= .348	1.0000 (0) P= .	-.1453 (47) P= .330	-.0975 (47) P= .515
GSEHS	-.0155 (48) P= .917	.4901 (48) P= .000	-.0074 (46) P= .961	-.1453 (47) P= .330	1.0000 (0) P= .	.2318 (48) P= .113
GSFHS	.3987 (48) P= .005	.2257 (48) P= .123	-.0115 (46) P= .939	-.0975 (47) P= .515	.2318 (48) P= .113	1.0000 (0) P= .

PEARSON CORRELATION OF HIGHEST SCORE ACROSS GENERATING STRATEGIES TASKS, 11 YEAR OLDS

APPENDIX 13: CHI SQUARE AND CONTINGENCY CO-EFFICIENT OF EACH WORD LIST GENERATION TASK WITH EACH OTHER FOR EACH CATEGORY OF ORGANISING PRINCIPLE

	Graphic		Phonic	
	X^2	C	X^2	C
Task A with task B	136.12	0.70	136.12	0.70
C	110.26	0.66	113.78	0.70
D	110.26	0.66	110.26	0.66
E	113.78	0.66	113.78	0.66
F	110.26	0.66	132.00	0.70
Task B with task C	110.26	0.66	113.78	0.66
D	110.26	0.66	110.26	0.66
E	113.78	0.66	113.78	0.66
F	110.26	0.66	132.00	0.70
Task C with task D	115.38	0.67	123.68	0.68
E	112.68	0.66	132.00	0.70
F	115.38	0.67	113.78	0.66
Task D with task E	123.68	0.68	123.68	0.68
F	123.68	0.68	134.00	0.70
Task E with task F	112.68	.66	113.78	0.66

	Description		Function	
	X^2	C	X^2	C
Task A with task B	5.44	0.19	93.44	0.63
C	12.25	0.28	93.44	0.63
D	21.78	0.36	103.36	0.65
E	28.44	0.41	100.00	0.64
F	28.02	0.40	70.89	0.57
Task B with task C	17.36	0.33	87.12	0.61
D	13.44	0.29	84.02	0.61
E	4.00	0.16	75.11	0.59
F	12.25	0.28	53.78	0.52
Task C with task D	10.02	0.25	134.00	0.70
E	14.70	0.30	113.78	0.66
F	9.00	0.24	72.27	0.57
task D with task E	13.44	0.29	134.00	0.70
F	1.36	0.10	66.09	0.56
Task E with task F	14.70	0.30	64.00	0.55

	Category		Co-ordinated	
	x^2	C	x^2	C
Task A with task B	0.64	0.55	11.00	0.27
C	40.1	0.47	18.76	0.34
D	51.36	0.52	23.36	0.37
E	56.25	0.53	25.00	0.38
F	25.00	0.38	6.00	0.20
Task B with task C	53.77	0.52	21.80	0.36
D	34.02	0.44	12.25	0.28
E	42.25	0.48	13.44	0.29
F	28.44	0.41	13.44	0.29
Task C with task D	46.69	0.49	26.70	0.40
E	46.69	0.49	18.76	0.34
F	36.00	0.45	18.76	0.34
Task D with task E	40.1	0.47	17.36	0.33
F	30.25	0.42	7.34	0.22
Task E with Task F	26.69	0.40	9.00	0.24

Specific Co-ordinated

	X^2	C
Task A with Task B	21.8	0.36
C	25.00	0.38
D	40.1	0.47
E	21.8	0.36
F	13.94	0.30
Task B with Task C	36.00	0.35
D	32.1	0.43
E	32.1	0.43
F	16.00	0.32
Task C with task D	44.44	0.49
E	49.00	0.50
F	18.76	0.34
Task D with task E	25.00	0.38
F	25.00	0.38
Task E with Task F	28.40	0.41

APPENDIX 14: CHI SQUARE AND CONTINGENCY CO-EFFICIENTS FOR SELECTION OF EACH ITEM IN JUDGING TASK DIFFICULTY, BY AGE GROUP

JUDGING TASK DIFFICULTY: CONTINGENCY COEFFICIENTS FOR SELECTION OF EACH ITEM WITH EACH OTHER, BY AGE GROUP

Age	11		9		7	
	X^2	C	X^2	C	X^2	C
1.1 with						
1.2	36.75	0.66	36.75	0.66	44.06	0.69
1.3	36.75	0.66	40.33	0.68	27.00	0.60
1.4	44.06	0.69	48.00	0.71	44.06	0.69
2.1	44.06	0.69	44.06	0.69	30.10	0.62
2.2	27.00	0.60	44.06	0.69	16.33	0.50
2.3	27.00	0.60	5.33	0.33	1.33	0.16
3.1	5.33	0.33	0.37	0.08	1.33	0.16
3.2	4.08	0.28	0.08	0.04	1.33	0.16
3.3	1.33	0.16	0.33	0.08	0.37	0.08
1.2 with						
1.3	48.00	0.71	44.06	0.69	30.10	0.62
1.4	40.33	0.68	36.75	0.66	46.33	0.68
2.1	40.33	0.68	33.33	0.64	33.33	0.64
2.2	36.75	0.66	40.33	0.68	18.75	0.53
2.3	18.75	0.53	2.08	0.20	2.08	0.20
3.1	2.08	0.20	3.00	0.24	0.38	0.08
3.2	1.33	0.16	1.33	0.16	0.38	0.08
3.3	0.83	0.13	2.08	0.20	1.33	0.16
1.3 with						
1.4	40.33	0.68	40.33	0.68	44.06	0.69
2.1	40.33	0.68	36.75	0.66	44.06	0.69
2.2	36.75	0.66	44.06	0.69	33.33	0.64
2.3	18.75	0.53	3.00	0.24	8.33	0.38
3.1	2.08	0.20	2.08	0.20	0.33	0.08
3.2	1.33	0.16	0.37	0.08	0.33	0.08
3.3	0.83	0.13	1.33	0.16	6.75	0.35

1.4 with 2.1	48.0	0.71	44.06	0.69	30.10	0.62
2.2	30.1	0.62	40.33	0.68	7.04	0.36
2.3	24.08	0.58	5.33	0.33	0.38	0.08
3.1	4.08	0.28	0.37	0.09	2.08	0.20
3.2	3.00	0.24	0.08	0.04	2.08	0.20
3.3	0.38	0.09	0.33	0.08	0.33	0.08
2.1 with 2.2	30.10	0.62	40.33	0.68	30.10	0.62
2.3	24.08	0.59	6.75	0.35	6.75	0.35
3.1	4.08	0.38	0.33	0.08	0.08	0.04
3.2	3.00	0.24	0.00	0.00	0.08	0.04
3.3	6.37	0.08	0.08	0.04	5.33	0.32
2.2 with 2.3	12.00	0.48	4.08	0.38	16.33	0.50
3.1	0.33	0.08	1.33	0.16	3.00	0.24
3.2	0.08	0.04	0.33	0.08	3.00	0.24
3.3	0.33	0.08	0.37	0.08	7.04	0.36
2.3 with 3.1	16.33	0.50	7.04	0.36	21.33	0.55
3.2	7.04	0.36	18.75	0.53	21.33	0.55
3.3	8.33	0.38	16.33	0.50	44.06	0.69
3.1 with 3.2	44.06	0.69	40.33	0.68	48.00	0.71
3.3	33.33	0.64	44.08	0.69	44.06	0.69
3.2 with 3.3	36.75	0.66	44.08	0.69	44.06	0.69

APPENDIX 15: PEARSON CORRELATION OF JUDGING TASK DIFFICULTY, RATIONALE, FOR WHOLE SAMPLE AND BY AGE GROUP

Pearson Correlation of Rationale within Item Set, Whole Sample

SET 1

	RITEMS1A	RITEMS1B	RITEMS1C	RITEMS1D
RITEMS1A	1.0000 (0) P= .	.3931 (144) P= .000	.3366 (144) P= .000	.4440 (144) P= .000
RITEMS1B	.3931 (144) P= .000	1.0000 (0) P= .	.4978 (144) P= .000	.3374 (144) P= .000
RITEMS1C	.3366 (144) P= .000	.4978 (144) P= .000	1.0000 (0) P= .	.3674 (144) P= .000
RITEMS1D	.4440 (144) P= .000	.3374 (144) P= .000	.3674 (144) P= .000	1.0000 (0) P= .

SET 2

	RITEMS2A	RITEMS2B	RITEMS2C
RITEMS2A	1.0000 (0) P= .	.7114 (144) P= .000	.5333 (144) P= .000
RITEMS2B	.7114 (144) P= .000	1.0000 (0) P= .	.6491 (144) P= .000
RITEMS2C	.5333 (144) P= .000	.6491 (144) P= .000	1.0000 (0) P= .

SET 3

	RITEMS3A	RITEMS3B	RITEMS3C
RITEMS3A	1.0000 (0) P= .	.6080 (144) P= .000	.5194 (144) P= .000
RITEMS3B	.6080 (144) P= .000	1.0000 (0) P= .	.5939 (144) P= .000
RITEMS3C	.5194 (144) P= .000	.5939 (144) P= .000	1.0000 (0) P= .

PEARSON CORRELATION OF RATIONALE WITHIN SET ONE, BY AGE

7 YEARS

	RITEMS1A	RITEMS1B	RITEMS1C	RITEMS1D
RITEMS1A	1.0000 (0) P= .	.5638 (48) P= .000	.3670 (48) P= .010	.4323 (48) P= .002
RITEMS1B	.5638 (48) P= .000	1.0000 (0) P= .	.4625 (48) P= .001	.5933 (48) P= .000
RITEMS1C	.3670 (48) P= .010	.4625 (48) P= .001	1.0000 (0) P= .	.2071 (48) P= .158
RITEMS1D	.4323 (48) P= .002	.5933 (48) P= .000	.2071 (48) P= .158	1.0000 (0) P= .

9 YEARS

	RITEMS1A	RITEMS1B	RITEMS1C	RITEMS1D
RITEMS1A	1.0000 (0) P= .	.2433 (48) P= .039	.3742 (48) P= .009	.4043 (48) P= .004
RITEMS1B	.2433 (48) P= .039	1.0000 (0) P= .	.6057 (48) P= .000	.1891 (48) P= .198
RITEMS1C	.3742 (48) P= .009	.6057 (48) P= .000	1.0000 (0) P= .	.5849 (48) P= .000
RITEMS1D	.4043 (48) P= .004	.1891 (48) P= .198	.5849 (48) P= .000	1.0000 (0) P= .

11 YEARS

	RITEMS1A	RITEMS1B	RITEMS1C	RITEMS1D
RITEMS1A	1.0000 (0) P= .	.1157 (48) P= .434	.3503 (48) P= .015	.4935 (48) P= .000
RITEMS1B	.1157 (48) P= .434	1.0000 (0) P= .	.3040 (48) P= .036	.1182 (48) P= .423
RITEMS1C	.3503 (48) P= .015	.3040 (48) P= .036	1.0000 (0) P= .	.3027 (48) P= .037
RITEMS1D	.4935 (48) P= .000	.1182 (48) P= .423	.3027 (48) P= .037	1.0000 (0) P= .

PEARSON CORRELATION OF RATIONALE WITHIN SET TWO; BY AGE

7 YEARS

	RITEMS2A	RITEMS2B	RITEMS2C
RITEMS2A	1.0000 (0) P= .	.6764 (48) P= .000	.3993 (43) P= .005
RITEMS2B	.6764 (48) P= .000	1.0000 (0) P= .	.3477 (48) P= .015
RITEMS2C	.3993 (43) P= .005	.3477 (43) P= .015	1.0000 (0) P= .

9 YEARS

	RITEMS2A	RITEMS2B	RITEMS2C
RITEMS2A	1.0000 (0) P= .	.7317 (48) P= .000	.4973 (48) P= .000
RITEMS2B	.7317 (48) P= .000	1.0000 (0) P= .	.7534 (48) P= .000
RITEMS2C	.4973 (43) P= .000	.7534 (48) P= .000	1.0000 (0) P= .

11 YEARS

	RITEMS2A	RITEMS2B	RITEMS2C
RITEMS2A	1.0000 (0) P= .	.3311 (48) P= .022	.4616 (48) P= .001
RITEMS2B	.3311 (48) P= .022	1.0000 (0) P= .	.4662 (48) P= .001
RITEMS2C	.4616 (43) P= .001	.4662 (48) P= .001	1.0000 (0) P= .

Pearson Correlation of Rationale within Set Three, by Age

7 YEARS

	RITEMS3A	RITEMS3B	RITEMS3C
RITEMS3A	1.0000	.4560	.6623
	(0)	(48)	(48)
	P= .	P= .001	P= .000
RITEMS3B	.4560	1.0000	.4825
	(48)	(0)	(48)
	P= .001	P= .	P= .001
RITEMS3C	.6623	.4825	1.0000
	(48)	(48)	(0)
	P= .000	P= .001	P= .

9 YEARS

	RITEMS3A	RITEMS3B	RITEMS3C
RITEMS3A	1.0000	.7472	.5200
	(0)	(48)	(48)
	P= .	P= .000	P= .000
RITEMS3B	.7472	1.0000	.5988
	(48)	(0)	(48)
	P= .000	P= .	P= .000
RITEMS3C	.5200	.5988	1.0000
	(48)	(48)	(0)
	P= .000	P= .000	P= .

11 YEARS

	RITEMS3A	RITEMS3B	RITEMS3C
RITEMS3A	1.0000	.5322	.3763
	(0)	(48)	(48)
	P= .	P= .000	P= .008
RITEMS3B	.5322	1.0000	.6569
	(48)	(0)	(48)
	P= .000	P= .	P= .000
RITEMS3C	.3763	.6569	1.0000
	(48)	(48)	(0)
	P= .008	P= .000	P= .

APPENDIX 16: FACTOR MATRICES FOR METACOGNITIVE VARIABLES AFTER PRINCIPAL AXIS FACTORING AND VARIMAX ROTATION FOR WHOLE SAMPLE AND EACH AGE GROUP

VARIMAX ROTATION 1 FOR EXTRACTION 1 IN ANALYSIS 1 - KAISER NORMALIZATION.

VARIMAX CONVERGED IN 8 ITERATIONS.

ROTATED FACTOR MATRIX:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6
GSAM	.10636	.72518	.45776	.00178	.09591	-.05143
GSAHS	.02104	.32412	.32820	-.03462	-.08983	.10121
GSBM	.07829	.13584	.38348	.02296	.65165	-.15522
GSBHS	.00688	.17315	.11476	.16801	.66847	.20167
GSCM	.01033	.01971	.68802	.05568	.10752	.03731
GSCHS	.04061	-.01296	.37387	.15361	.10546	.12841
GSEM	.09163	.30167	.46198	.03830	.08346	.12310
GSEHS	.17302	.50378	.08920	.19918	.21357	.13779
GSFM	-.06187	.11905	.49572	.32053	.06198	-.21233
GSFHS	.04390	.45436	.24487	.15940	.05120	.04456
THS	.15033	.12009	.23752	.72282	.02708	.19369
OS	.15017	.31037	.05220	.76005	.19946	.05269
GPTOT	-.71041	-.03963	.05534	.03252	-.03252	.32867
CATTOT	.90111	.09796	.03508	.12234	.03604	-.12124
CORDTOT	.87819	.11750	.11659	.09103	-.00443	.14982
GPCTOT	.63539	.11663	.01427	.17189	.06231	.32982
VAT1	-.03753	.[illegible]845	.37736	.12704	.05502	.52484
VAT2	.17277	.63192	.12771	.35761	.05434	.13473
VAT3	.03080	.00708	.04259	.02552	.03835	-.23439

Factor Matrix Following Varimax Rotation of Metacognitive Variables, whole Sample

VARIMAX ROTATION 1 FOR EXTRACTION 1 IN ANALYSIS 1 - KAISER NORMALIZATION.

VARIMAX CONVERGED IN 4 ITERATIONS.

ROTATED FACTOR MATRIX:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7
GSAM	.18433	-.06600	-.10220	.76076	-.13749	-.13703	.20343
GSAHS	-.10138	.07219	.00673	.81027	.08859	.18500	-.06696
GSBM	.05364	-.13876	.03517	-.03287	-.14475	.22237	.56108
GSBHS	-.17727	-.07903	-.06900	.07657	.08589	.03847	.32797
GSCM	-.02805	.24374	.12613	.17283	-.05496	.00685	.55230
GSCHS	-.12849	.44274	-.10320	-.16541	-.38945	-.10747	.40247
GSEM	.07039	.02326	.92208	.12450	.04517	-.12275	.26632
GSFHS	.06985	.19461	.64569	-.01443	-.00203	.11412	-.05725
GSFM	.07376	.40796	.01385	.05977	.04248	-.15690	.13831
GSFHS	.10986	.67636	.01701	-.13588	.03447	.02008	-.02530
THS	-.15578	-.00393	.08162	.03563	.66402	-.15756	-.19387
OS	.11099	.20454	.09512	-.11960	.73081	.15769	.00167
CPTOT	-.67899	-.07636	.10666	.03505	.01658	.27286	-.29969
CAITOT	.39564	.08976	-.00821	-.09380	.05102	-.13920	.01282
CORDTOT	.92796	.09600	.10014	.02221	.00750	.01250	-.03379
CPCTOT	.61792	.08436	.07955	.14913	-.04574	.24059	-.13362
RAT1	-.08569	.35295	.22614	.00627	-.13135	.45550	.09642
RAT2	-.02338	.46376	.24759	.11582	.00191	.04073	-.20689
RAT3	.12378	.4[illegible]39	.00735	.09147	.02715	-.09367	-.07157

FACTOR MATRIX FOLLOWING VARIMAX ROTATION OF METACOGNITIVE VARIABLES, 7 YEAR OLDS

VARIMAX ROTATION 1 FOR EXTRACTION 1 IN ANALYSIS 1 - KAISER NORMALIZATION.

VARIMAX CONVERGED IN 12 ITERATIONS.

ROTATED FACTOR MATRIX:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7
GSAM	.00655	.62047	.12315	-.00253	-.02667	-.01740	-.00284
GSAHS	.33070	.56049	.10358	.09784	.14697	-.06105	.28786
GSBM	.07499	.50802	.04597	.02999	-.32091	.55699	-.08454
GSBHS	.00219	.05663	.04220	.02649	-.05251	.84966	-.01410
GSCM	.09240	.62531	-.04336	.08371	.20459	.18512	.02054
GSCHS	.08223	.42051	.17233	.06524	.30440	.20943	.01916
GSEM	.26076	.76764	.13790	.30726	.34035	.06229	.02495
GSEHS	.13406	.17489	.50456	.29434	-.02291	.05124	.16585
GSFM	-.07610	.78971	.18043	.22924	-.73107	-.03376	-.50970
GSFHS	-.00251	[illegible]	.16175	[illegible]	.02730	[illegible]	-.00035
THS	.06058	.27103	.52236	.09778	.42010	-.02927	-.25456
IS	[illegible]	.16079	[illegible]	.07205	.12445	.05705	[illegible]
[illegible]PTOT	[illegible]	[illegible]	[illegible]	.16269	.01766	.01325	.02603
[illegible]ATTOT	[illegible]	[illegible]	[illegible]	.01936	.01265	[illegible]	-.05135
[illegible]CCDTOT	[illegible]	.13477	.05316	.13615	.05454	.04767	.03226
SPCTOT	.07877	-.25605	.07021	.33822	.15387	.13872	.15082
RAT1	-.39150	.05402	.01630	.07847	[illegible]	-.15424	-.20812
RAT2	[illegible]	[illegible]	[illegible]	.65903	.16312	-.04233	[illegible]
RAT3	-.01171	.06984	.14413	.19610	-.23874	-.04013	[illegible]

Factor Matrix Following Varimax Rotation of Metacognitive Variables, 9 Year Olds

VARIMAX ROTATION 1 FOR EXTRACTION 1 IN ANALYSIS 1 - KAISER NORMALIZATION.

VARIMAX CONVERGED IN 14 ITERATIONS.

ROTATED FACTOR MATRIX:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7
GSASM	.19452	-.04543	.24227	-.20067	-.03654	.40796	.07604
GSAHS	-.13454	-.00471	.84567	.13876	-.09634	.05996	.01754
GSBM	.41577	-.04733	.31635	-.04870	.09048	.19102	-.16094
GSBHS	.70061	.02474	-.10928	.02292	-.03795	.24942	.07466
GSCM	-.37634	-.06541	.15078	.05736	.21077	.53811	-.12572
GSCHS	[illegible]	.05190	-.20520	.14175	-.01723	.44537	.16659
GSEM	[illegible]	-.33470	[illegible]	.15305	.12970	.61338	-.11794
GSEHS	[illegible]	.33769	.00938	[illegible]	-.03443	-.11702	-.00151
GSFM	-.62018	[illegible]	.21561	.46597	.37204	.34170	-.50166
GSFHS	.25545	[illegible]	.50575	[illegible]	[illegible]	[illegible]	-.06205
THS	-.04560	[illegible]	[illegible]	.07628	[illegible]	[illegible]	.37539
DS	-.30763	[illegible]	.10921	-.11704	.09590	[illegible]	-.03634
[illegible]TOT	.13316	-.02104	-.03465	.73577	-.04071	.10763	.04701
CATTOT	.08420	.70949	.20055	-.75755	.03300	-.00520	.04006
CORRTOT	-.36430	.66998	[illegible]	-.32957	.17701	.32009	.17515
SPCTOT	.07903	.90649	[illegible]	[illegible]	.00117	[illegible]	.12932
RAT1	-.06317	.30235	.01655	.01492	.17406	.02673	.32412
RAT2	.24261	.06715	.41937	.11390	.25104	-.13107	[illegible]
RAT3	.40589	-.29375	.41200	-.11360	-.02412	.10285	.00652

FACTOR MATRIX FOLLOWING VARIMAX ROTATION OF METACOGNITIVE VARIABLES; 11 YEAR OLDS

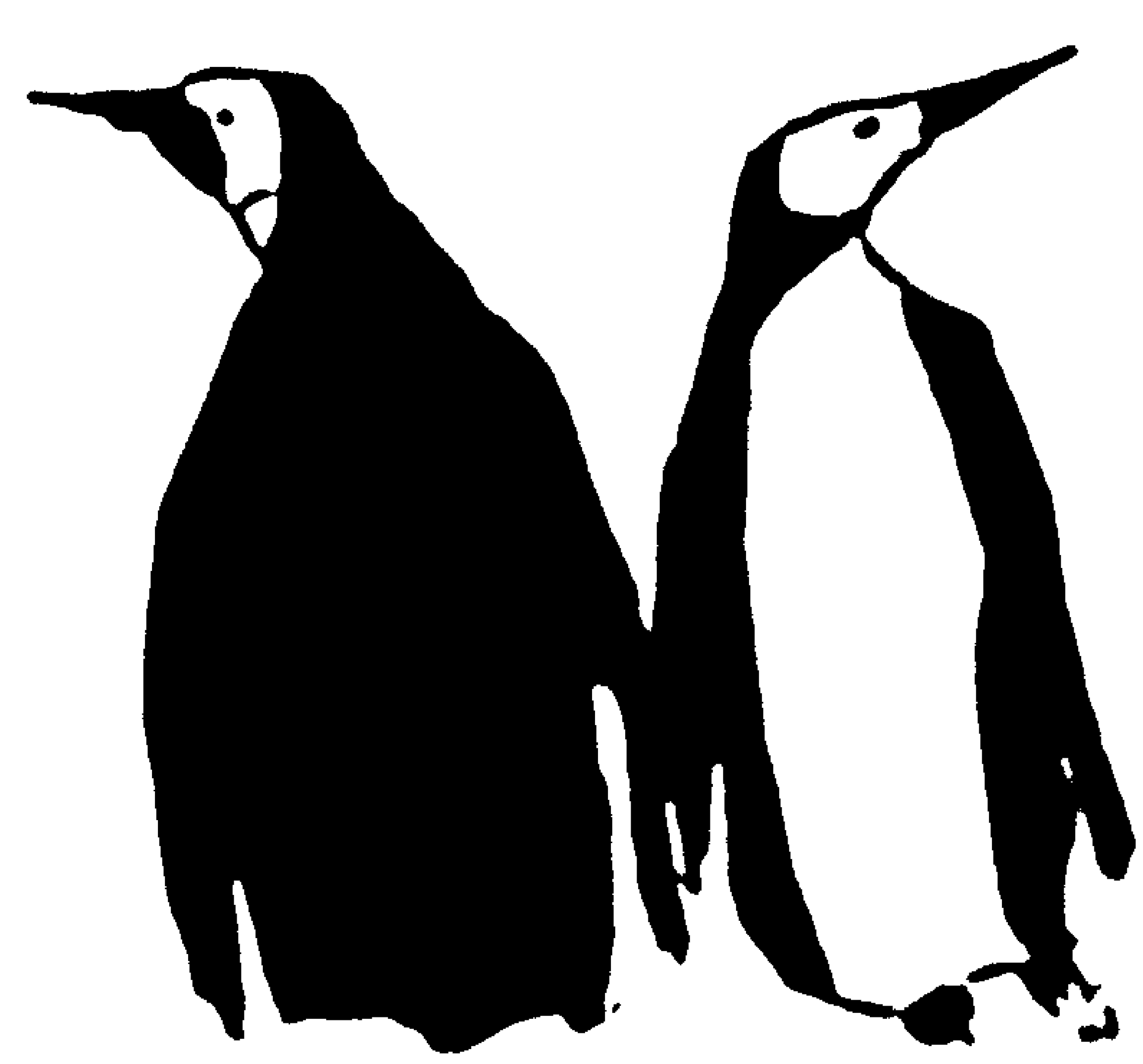
APPENDIX 17: PROSE PASSAGES

PENGUINS

Often when people think of the frozen regions of the world they think of penguins and polar bears. But penguins and polar bears are never found near each other except in zoos. Polar bears live in the Arctic in the North Pole. Penguins live in the Antarctic in the frozen regions around the South Pole.No penguins live north of the Equator.

Penguins are birds that cannot fly. There are 18 different species of penguin. They vary in size and pattern of colour . The commonest type is the Adelie. You can see it in most zoos. It is black on the head, back and wings and white on the chest like a man in dinner dress.On land it usually stands upright and waddles along with its head in the air. The colour of the penguin is designed to protect it from its enemies. It is a kind of camouflage. When it is swimming it is dark from above and is hard to see against the blackness of the water below. An enemy swimming beneath, on the other hand, is confused by the bright light of the sky and may not see the penguin's light underparts.

The penguin's body is splendidly adapted for life in the sea. It is streamlined for swimming like a fish or seal. If the penguin had large wings they would get in the way and act like brakes when it was swimming. Their small wings are more like flippers and in the sea can be used as strong paddles. The penguins thick oily feathers protect it from the cold and wet.



Peking is the capital of China which is the only country in the world where pandas are found . Over a thousand miles away to the south-west of Peking lies the Sichuan Province. The western part of this region is very mountainous and wet. Bamboo grows here and there is very lush vegetation. It is an area where many interesting animals can be found. More than 200 kinds of birds and 50 species of animals make there home here. The rarest and most exciting of all these animals is the giant panda.

Giant pandas are bear-like animals. Their heads , backs, bellies and hauches are all covered with long, thick white fur while their legs are all black. Panda's heads are even more unusual. Their ears are round and black in contrast to the rest of their head which is white. Around their eyes a patch of black fur grows giving them the appearance of wearing goggles.

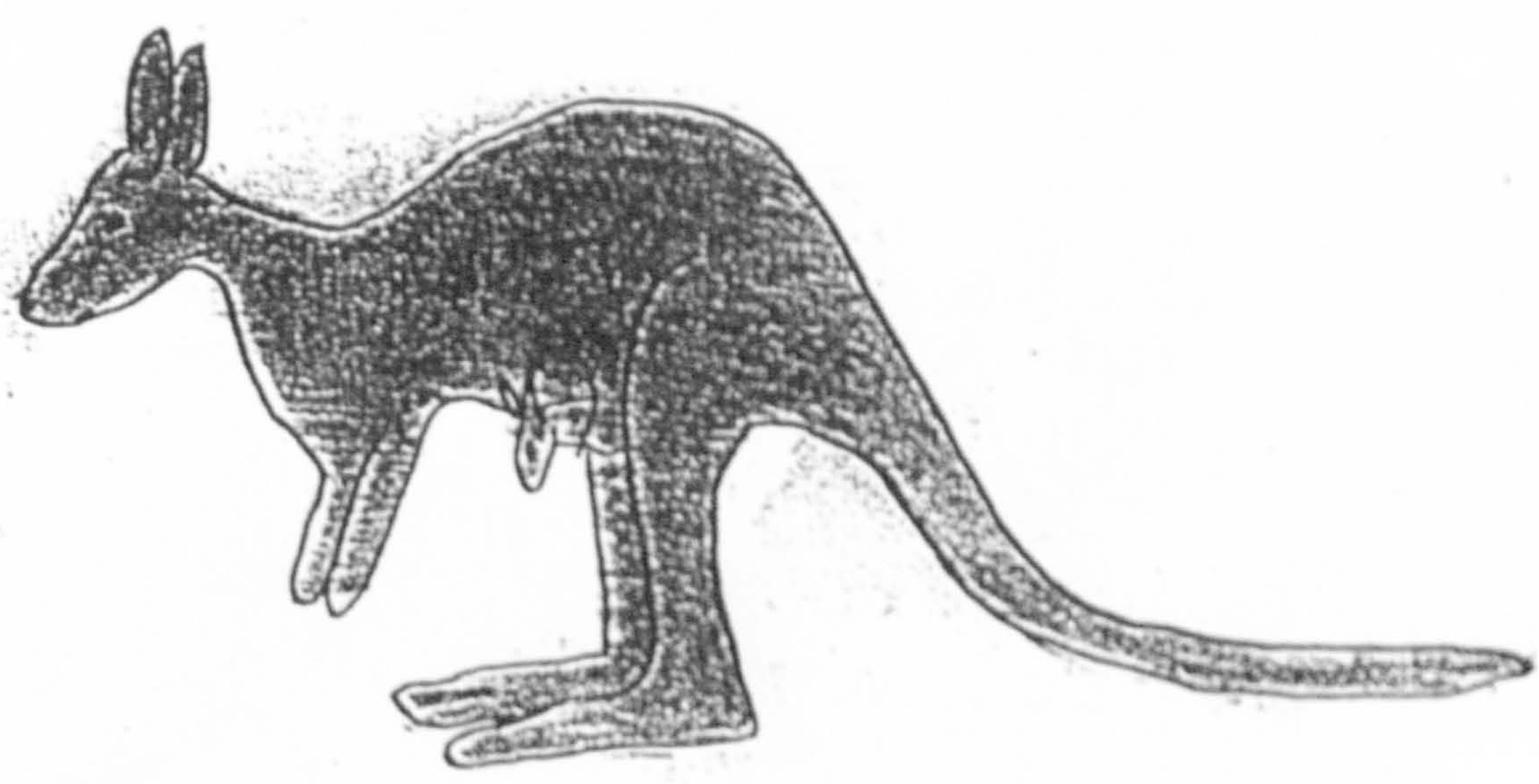
Giant pandas feed mainly on bamboo. They eat the shoots,stalks branches and leaves of the bamboo plant . They also like to eat reeds and sugar cane. Some people think pandas are vegetarians. This is not true. They sometimes eat meat too. Pandas like to eat bamboo rats which are small creatures that live in the bamboo groves . Pandas enjoy drinking water. Once they start drinking they don't like to stop. In fact they drink so much that their tummies become bloated and they can hardly move.The drinking habits of pandas is of great interest to zoologists.

KANGAROOS

The kangaroo is a most interesting and unusual animal which is found only in Australia. When it is born it is only one inch long but full grown it is taller than most men. It has very strong legs and tail which help it to move along in great big hops. It can move very fast. Big kangaroos can travel at 35 miles per hour.

Baby kangaroos are called joeys. They live in a pouch at the front of their mother's body. When they are first born they spend all the time in their mother´s pouch. As they get older they spend more time out of the pouch and only climb in to the pouch when they are frightened and there is something dangerous about.

Kangaroos usually are found in groups. A group of kangaroos is called a mob. A mob is like a family .



APPENDIX 18: POST TESTS

7 YEARS

	true	untrue
New-born kangaroos like to hop about.	☐	☐
Baby kangaroos are called joeys.	☐	☐
Kangaroos live only in Australia.	☐	☐
Joeys hide in their mother's pouch when they are frightened.	☐	☐
Full grown kangaroos would be about as tall as someone in your class.	☐	☐
Big kangaroos can travel at 55 miles per hour.	☐	☐
Kangaroos are usually found together in pairs.	☐	☐
A new born kangaroo is only one inch long.	☐	☐
Kangaroos are usually found together in groups like a family.	☐	☐
Once a joey is old enough to hop about it never goes in its mother's pouch.	☐	☐

	yes	no
Kangaroos are usually found in groups.	☐	☐
It can move very fast	☐	☐
Joeys live in a pouch.	☐	☐
A mob is like a family.	☐	☐
When it is born it is only one inch long but full grown it is taller than most men.	☐	☐
Kangaroos have great big tails.	☐	☐
The kangaroo is found only in Australia.	☐	☐
A mob is a group of kangaroos.	☐	☐
The kangaroo is a most interesting and unusual animal which is found only in Australia.	☐	☐
It can hop very quickly.	☐	☐

9 YEARS

	true	untrue
All penguins have the same pattern of black and white markings	☐	☐
Penguins can only fly short distances.	☐	☐
Penguins are only found South of the Equator.	☐	☐
There are 17 different different types of penguin in addition to the Adelie which is the most common	☐	☐
The black and white colouring of a penguin is to protect it from its enemy, the polar bear.	☐	☐
Penguins live in the Arctic region.	☐	☐
The penguin, although a bird, has a body which is better adapted for life in the sea.	☐	☐
The penguin's colouring is a camouflage which protects it from its enemies	☐	☐
Penguins and polar bears are never found together in the wild.	☐	☐
The penguin's wings act like brakes when it is swimming	☐	☐

	yes	no
Their small wings are like flippers in the sea and can be used as strong paddles	☐	☐
Zoos are the only place where you find penguins and polar bears together	☐	☐
There are 18 kinds of penguin.	☐	☐
The Adelie is a common type of penguin.	☐	☐
Against the blackness of the water the penguins feathers are hard to see	☐	☐
You can see it in most zoos.	☐	☐
Pengins live in the Antarctic in the frozen regions around the South pole.	☐	☐
The oil on a penguin's feathers protect it from the ice cold.	☐	☐
It is a kind of camouflage.	☐	☐
They vary in size and pattern of colour.	☐	☐

11 YEARS

	true	untrue
The panda unlike most animals in the bear family prefer a vegetarian diet.	☐	☐
Pandas have an unusual habit of drinking so much that they become bloated and almost unable to move	☐	☐
Sichuan Provence is a great distance from the Chinese capital, Peking.	☐	☐
The landscape across the entire Sichuan Provence is very mountainous.	☐	☐
Pandas are found near Peking.	☐	☐
Pandas hind legs are white in colour.	☐	☐
Pandas live in dry but mountainous regions.	☐	☐
Sichuan Provence is a thousand miles due West of Peking.	☐	☐
Pandas have a mixed diet of plants and small animals.	☐	☐
The lush vegetation of the western part of the Sichuan Provence attracts numerous species of animal.	☐	☐

	yes	no
The drinking habits of pandas are of great interest to zoologists.		
Some people think pandas are vegetarian.		
Pandas love water.		
Their ears are round and black in contrast to the rest of their head which is white.		
Bamboo grows in the Sichuan Provence.		
Around their eyes is a patch of black fur which looks like a pair of glasses.		
Pandas are not vegetarians.		
The rarest and most exciting of these animals is the giant panda.		
Peking is the capital of China and the place where Pandas are found		
The Western part of the region is very mountainous and wet		

APPENDIX 19: ILLUSTRATIVE SET

In the winter it is very cold and sometimes it snows

	true	untrue
Snow comes in the winter time when it is very cold	☐	☐
It snows everyday in the winter	☐	☐

	yes	no
In the winter it is very cold and sometimes it snows.	☐	☐
In the winter it is very chilly and sometimes it snows.	☐	☐

APPENDIX 20: PRACTICE QUESTIONS

	true	untrue
The kangaroo has a very small tail.	☐	☐
Kangaroos live in Australia.	☐	☐

	yes	no
Baby kangaroos are called joeys.	☐	☐
When it is born it is only one inch long but full grown it is bigger than a man.	☐	☐

	true	untrue
Penguins are like emus and ostriches because they are birds that do not fly.		
Penguins live in hot countries.		

	yes	no
Often when people think of the frozen regions of the world they think of penguins and polar bears.		
Polar bears live in the North Pole.		

	true	untrue
The panda's main diet is the bamboo plant.	☐	☐
Panda's are found living in the wild in many countries.	☐	☐

	yes	no
Giant pandas are bear-like animals.	☐	☐
Giant pandas feed mostly on bamboo.	☐	☐

APPENDIX 21: OUTCOME DEFINITION RESPONSE SCHEDULE

Standardised formats were used to elicit or define learning outcome. These are presented below.

SELF DEFINED

You scored *x* out of ten.

Do you think you did well?

Probe

Is it a good score? a bad score?

Are you pleased with your score?

EXPERIMENTER DEFINED

The normative score derived in pilot study 6 were used to define outcome. Outcome was presented as follows

Success

You scored *x* out of ten. That is very good. That is more than most children of your age usually score

Average

You scored *x* out of ten. That is average. That is what most children of your age score.

Failure

You scored *x* out of ten. That is not very good. Most children of your age would score higher.

APPENDIX 22: ATTRIBUTION RESPONSE SCHEDULE

Standardised questions were used to elicit attributions. The first is an an open question the second is designed as a check procedure and a direct question about the stability of response.

Question 1

Why did you do badly/ do well/ get an "average" (use child's word in self defined condition) score

Question 2

Could you improve next time? How?

APPENDIX 23: ATTRIBUTION CODING SCHEDULE

Sixteen classes of attribution are included in the schedule. All attribution statements are to be classified. The status of each is equal.

CATEGORIES

Strategy-Reading:

Any response referring to the strategy of reading

Example

"I read it well"

"I read it lots of times"

"I read the difficult bits more"

Strategy- Learning

Responses referring to strategies of retrieval and storage

Example

"I learned the difficult bits more"

"I memorised it"

"I put a picture of the story in my mind"

"I thought about the things I already knew then the story... it helped me to remember"

N.B. The response "I thought about it is not classified here. This is an Effort attribution"

Stategy-Recall

Responses referring to strategies used in answering the test

examples

"I checked the questions"

" If they (questions) were only slightly changed I was more likely to get them wrong. I looked for big changes...."

" The questions reminded me of the story. I used the information in the questions to help me answer"

Effort-Concentration

Responses which convey a qualitative notion of "trying hard"

Examples

"I concentrated"

"I paid attention"

"I thought hard"

Effort- Time Spent

Responses which convey a qualitative notion of effort in which effort is measured by time spent.

Examples

"I spent a long time"

"I rushed through"

"I didn't think long enough"

Interest

Responses which refer to interest in the subject matter or task format

Examples

".. because Pandas are my favourite animals"

"I liked doing these tests"

Knowledge

refers to specific knowledge about the subject matter.

Example

"I've done work about kangaroos. I know about kangaroos"

Specific Ability

Responses which refer to Specific Ability to do the task.

Examples

"I'm good at reading"

"I'm good at these sorts of tests"

"We do these sorts of tests in English and I usually do well"

General Ability

Reference to general competence.

Examples

"I usually do well at school

"I'm quite clever"

Task Difficulty-Passage

Reference to level of difficulty of the reading material

Examples

"It was very long. It was hard to remember"

There was a lot to remember"

"It was difficult to read"

Task Difficulty-Test

Reference to the level of difficulty of the test.

Examples

"The questions changed just the most important bits. That made it easy"

"It was easy because we answered just a few seconds after reading it"

Outcome

Reference made to the score- criterion of normative reference.

Examples
"I would usually get a better score"

"I did better than most children do"

Chance Guessing

Notion of predicting the test.

Example
"I thought about what questions might be in the test. I guessed right"

Chance Luck

Reference to fate.

Example
"I was just lucky"

Circumstance Mood

Reference to emotional state

Example
"I was a bit nervous"

Circumstance Situation

Reference to context/environment

Example
"It was very noisy"

APPENDIX 24: PEARSON CORRELATION OF MCA AND MCZ WITH ATTRIBUTION TYPE AND ATTRIBUTION DIMENSION FOR EACH EXPERIMENTAL GROUP

Verbatim/External

	INTERNAL	EXTERNAL	CONTROL	UCONTROL	GLOBAL	SPECIFIC	STABLE	USTABLE
	.3946	.0608	.2696	.2226	.0105	.3522	-.0815	.4357
MCA	(72)	(72)	(72)	(72)	(72)	(72)	(72)	(72)
	P= .000	P= .306	P= .011	P= .030	P= .465	P= .001	P= .248	P= .000

Verbatim/Self Defined

	INTERNAL	EXTERNAL	CONTROL	UCONTROL	GLOBAL	SPECIFIC	STABLE	USTABLE
	.5770	.0032	.4392	.2453	-.2060	.5633	.0079	.5715
MCA	(72)	(72)	(72)	(72)	(72)	(72)	(72)	(72)
	P= .000	P= .473	P= .000	P= .019	P= .041	P= .000	P= .474	P= .000

Meaningful/External

	INTERNAL	EXTERNAL	CONTROL	UCONTROL	GLOBAL	SPECIFIC	STABLE	USTABLE
	.1560	.0689	.1227	.0978	.2738	.1023	.0752	.1486
MCA	(63)	(68)	(68)	(68)	(68)	(68)	(68)	(68)
	P= .102	P= .288	P= .159	P= .214	P= .012	P= .203	P= .271	P= .113

Meaningful/Self Defined

	INTERNAL	EXTERNAL	CONTROL	UCONTROL	GLOBAL	SPECIFIC	STABLE	USTABLE
	.1975	.0367	.1323	.1110	.0035	.2163	.0476	.1910
MCA	(70)	(70)	(70)	(70)	(70)	(70)	(70)	(70)
	P= .051	P= .381	P= .137	P= .180	P= .488	P= .036	P= .348	P= .057

PEARSON CORRELATION OF MCZ WITH ATTRIBUTION DIMENSION

Verbatim/External

	STRAT1	STRAT2	STRAT3	EFFORT1	EFFORT2	KNOW	ABILITY1	TASK1	TASK2
	.4082	-.0395	-.0516	.0586	.0000	.1741	.3674	.0348	.1757
MCZ	(36)	(36)	(36)	(36)	(36)	(36)	(36)	(36)	(36)
	P= .007	P= .410	P= .332	P= .367	P= .500	P= .155	P= .014	P= .420	P= .153

Verbatim/Self Defined

	STRAT1	STRAT2	STRAT3	EFFORT1	EFFORT2	KNOW	ABILITY1	TASK1	TASK2
	.3520	.4250	.0097	-.0271	.0933	.1258	.3841	.3177	.0113
MCZ	(36)	(36)	(36)	(36)	(36)	(36)	(36)	(36)	(36)
	P= .013	P= .005	P= .478	P= .438	P= .294	P= .232	P= .010	P= .030	P= .474

Meaningful/External

	STRAT1	STRAT2	STRAT3	EFFORT1	EFFORT2	KNOW	ABILITY1	TASK1	TASK2
	.0587	-.1176	-.1892	.0587	.0029	-.2907	.2132	.1617	-.0423
MCZ	(33)	(33)	(33)	(33)	(33)	(33)	(33)	(33)	(33)
	P= .373	P= .257	P= .146	P= .373	P= .494	P= .050	P= .117	P= .184	P= .408

Meaningful/Self D fined

	STRAT1	STRAT2	STRAT3	EFFORT1	EFFORT2	KNOW	ABILITY1	TASK1	TASK2
	-.1193	.3500	-.1957	-.0847	.0635	.2940	.2195	.	.2683
MCZ	(35)	(35)	(35)	(35)	(35)	(35)	(35)	(35)	(35)
	P= .246	P= .020	P= .130	P= .314	P= .359	P= .043	P= .103	P= .	P= .060

Pearson Correlation of MCZ with Attribution Type

Verbatim/External

	STRAT1	STRAT2	STRAT3	EFFORT1	EFFORT2	KNOW	ABILITY1	TASK1	TASK2
MCA	.4182	.1039	.1089	-.0576	.0716	.2623	.2263	-.1154	.1188
	(72)	(72)	(72)	(72)	(72)	(72)	(72)	(72)	(72)
	P= .000	P= .193	P= .181	P= .315	P= .275	P= .013	P= .028	P= .167	P= .160

Verbatim/Self Defined

	STRAT1	STRAT2	STRAT3	EFFORT1	EFFORT2	KNOW	ABILITY1	TASK1	TASK2
MCA	.3660	.4817	.1041	.0902	.0814	.2404	.3020	.2419	-.0976
	(72)	(72)	(72)	(72)	(72)	(72)	(72)	(72)	(72)
	P= .001	P= .000	P= .192	P= .226	P= .248	P= .021	P= .005	P= .020	P= .207

Meaningful/External

	STRAT1	STRAT2	STRAT3	EFFORT1	EFFORT2	KNOW	ABILITY1	TASK1	TASK2
MCA	.1658	.2276	-.1413	-.1324	.1007	-.0378	.2577	.0484	-.0782
	(68)	(68)	(68)	(63)	(68)	(68)	(68)	(68)	(68)
	P= .088	P= .031	P= .125	P= .141	P= .207	P= .380	P= .017	P= .348	P= .263

Meaningful/Self Defined

	STRAT1	STRAT2	STRAT3	EFFORT1	EFFORT2	KNOW	ABILITY1	TASK1	TASK2
MCA	.1021	.2630	-.2319	-.1999	.2256	.1399	-.0453	.	.0579
	(70)	(70)	(70)	(70)	(70)	(70)	(70)	(70)	(70)
	P= .200	P= .014	P= .027	P= .049	P= .030	P= .124	P= .355	P= .	P= .317

Pearson Correlation of MCA with Attribution Type

<u>Verbatim/External</u>

	INTERNAL	EXTERNAL	CONTROL	UCONTROL	GLOBAL	SPECIFIC	STABLE	USTABLE
MCA	.3946	.0608	.2696	.2226	.0105	.3522	-.0815	.4357
	(72)	(72)	(72)	(72)	(72)	(72)	(72)	(72)
	P= .000	P= .306	P= .011	P= .030	P= .465	P= .001	P= .248	P= .000

<u>Verbatim/Self Defined</u>

	INTERNAL	EXTERNAL	CONTROL	UCONTROL	GLOBAL	SPECIFIC	STABLE	USTABLE
MCA	.5770	.0032	.4392	.2453	-.2060	.5633	.0079	.5715
	(72)	(72)	(72)	(72)	(72)	(72)	(72)	(72)
	P= .000	P= .473	P= .000	P= .019	P= .041	P= .000	P= .474	P= .000

<u>Meaningful/External</u>

	INTERNAL	EXTERNAL	CONTROL	UCONTROL	GLOBAL	SPECIFIC	STABLE	USTABLE
MCA	.1560	.0689	.1227	.0978	.2738	.1023	.0752	.1486
	(63)	(68)	(68)	(68)	(68)	(68)	(68)	(68)
	P= .102	P= .288	P= .159	P= .214	P= .012	P= .203	P= .271	P= .113

<u>Meaningful/Self Defined</u>

	INTERNAL	EXTERNAL	CONTROL	UCONTROL	GLOBAL	SPECIFIC	STABLE	USTABLE
MCA	.1975	.0367	.1323	.1110	.0035	.2163	.0476	.1910
	(70)	(70)	(70)	(70)	(70)	(70)	(70)	(70)
	P= .051	P= .381	P= .137	P= .180	P= .488	P= .036	P= .348	P= .057

Pearson Correlation of MCA with Attribution Dimension

APPENDIX 25: META-ANALYSIS OF CORRELATION MATRICES

(A) METACOGNITVE INDICES WITH EACH ATTRIBUTION TYPE
(B) METACOGNITIVE INDICE WITH EACH ATTRIBUTION DIMENSION

Meta-analysis of correlation matrices for each age group: Mean correlation of each metacognitive index with each attribution type

	CATTOT	SPCTOT	RAT2	GSEHS	GSAM	GSCM	OS	THS
STRAT1	0.07	-0.01	0.06	0.02	0.32**	0.05	0.18*	0.07
STRAT2	-0.03	0.01	0.08	0.05	0.17*	0.23**	0.18*	0.07
STRAT3	0.04	0.11	0.04	-0.04	0.02	0.14	0.01	0.10
EFFORT1	0.12	0.09	0.14	-0.06	0.05	0.04	-0.05	0.06
EFFORT2	0.10	0.08	-0.10	0.30**	0.07	-0.03	0.14	0.06
KNOW	-0.03	0.03	0.11	0.03	-0.09	0.01	0.04	0.07
ABILITY	0.19*	0.04	0.26	0.06	0.15*	0.09	0.02	0.07
TASK1	0.04	0.06	0.11	0.12	0.08	0.17*	0.04	0.02
TASK2			0.01	0.01	0.18*	0.01	-0.11	-0.10

* $P < 0.05$

** $P < 0.01$

Meta- analysis of correlation matrices for each age group: Mean correlation of each metacognitive index with each attribution dimension .

	CATTOT	SPCTOT	RAT2	GSEHS	GSAM	GSCM	OS	THS
INTERNAL	0.11	0.07	0.13	0.12	0.18*	0.12	0.19	0.14
EXTERNAL	-0.07	0.03	0.10	0.08	0.14	0.08	-0.06	-0.10
CONTROL	0.12	0.07	0.10	0.12	0.22**	0.12	0.18*	0.10
UCONTROL	-0.07	0.02	0.17*	0.06	0.05	0.08	0.02	-0.02
STABLE	-0.10	-0.04	0.07	0.02	0.13	0.16*	-0.04	-0.04
USTABLE	0.12	0.09	0.15*	0.15*	0.19*	0.11	0.18*	0.11
GLOBAL	0.16*	-0.01	0.07	0.05	0.00	-0.04	-0.03	-0.06
SPECIFIC	0.10	0.08	0.16*	0.13	0.23**	0.15*	0.16*	0.11

* P < 0.05

** P < 0.01